Exhibit L

EXPERT REPORT OF
DR. ROBERT H. POPPENGA, DVM, PhD, DABVT

1. INTRODUCTION:

Plaintiff Daniel Zeiger has filed a lawsuit alleging that Defendant WellPet LLC ("WellPet") has misrepresented the healthfulness of three formulas of Wellness brand dog food due to the presence of "unsafe" and "dangerous" levels of arsenic, lead, and bisphenol-A (BPA) in the food. The three formulas are: (1) Wellness Core Ocean Whitefish, Herring Meal & Salmon Meal Recipe ("Core Ocean"); (2) Wellness Complete Health Adult Whitefish & Sweet Potato Recipe ("Sweet Potato"); and (3) Wellness Complete Health Grain Free Adult Whitefish & Menhaden Fish Meal Recipe ("Menhaden"). I am a veterinary toxicologist and I have been retained as an expert in this matter for WellPet to address whether the levels of arsenic, lead, and BPA at issue pose a health risk to dogs.

2. PROFESSIONAL EXPERIENCE AND QUALIFICATIONS:

I am a Professor of Clinical and Diagnostic Veterinary Toxicology and Head of the Toxicology Section at the California Animal Health and Food Safety Laboratory (CAHFS), School of Veterinary Medicine (SVM), University of California at Davis (UCD). The Toxicology Laboratory at CAHFS is one of the busiest of its kind in the world and offers comprehensive diagnostic toxicology testing. The laboratory is a member of the Food Emergency Response Network (FERN) and the Veterinary Laboratory Investigation and Response Network (VetLIRN), two national laboratory networks led by the U.S. Food and Drug Administration (FDA) and focused on human and animal food safety. I have been a faculty member at CAHFS and SVM since 2004. I teach veterinary toxicology to veterinary students at the UCD SVM, and advise residents in diagnostic veterinary toxicology at CAHFS.

I have almost 33 years of experience as a diagnostic veterinary toxicologist, including previous faculty and diagnostic laboratory positions at Michigan State University College of Veterinary Medicine (1987-1993), and the University of Pennsylvania School of Veterinary Medicine (1993-2004). Prior to that, I practiced small animal veterinary medicine for four years before returning to school to pursue a PhD and specialty training in veterinary toxicology. During my specialty training, I served as a staff veterinarian for the National Animal Poison Control Center (NAPCC) at the University of Illinois College of Veterinary Medicine.

I am board-certified by the American Board of Veterinary Toxicology (ABVT), which is the American Veterinary Medical Association (AVMA) approved organization that certifies veterinarians in the specialty of veterinary toxicology. I received my DVM and PhD degrees from the University of Illinois in 1978 and 1987, respectively.

My curriculum vitae, which includes my educational background, experience, and qualifications in more detail, along with my publications, is attached as **Exhibit A**.

3. **PRIOR TESTIMONY:**

During the previous four years, I have testified as an expert at trial or by deposition in the following cases: *Raza v. Spain and Randall*, No. SC 122344, Superior Court in the State of California, County of Los Angeles, Central District (2016/2017); *Loeb v. Champion Petfoods*, No. 18-cv-494-JPS, Eastern District of Wisconsin (January 2019); and *Reitman v. Champion Petfoods*, No. 2:18-CV-01736-DOC, Central District of California (May 2019, August 2019).

4. **COMPENSATION:**

I am being paid for my work on this matter at an hourly rate of $300. My compensation does not depend on the outcome of the case.

5. **INFORMATION CONSIDERED:**

In reaching my opinions, I considered the materials listed at **Exhibit B**.

6. **SUMMARY OF OPINIONS:**

The following opinions are formed based on my education, training and experience in the field of veterinary toxicology as well as my investigation in this case as detailed below.[1] These opinions are based on a reasonable degree of scientific certainty:

A) Arsenic and lead occur in nature and the environment and are routinely found in pet foods at safe levels.

B) The maximum tolerable levels (MTLs) established by the National Research Council and followed by FDA are the best and most widely used scientific guidance available to veterinary toxicology and nutrition experts for determining safe levels of arsenic and lead in dog food.

C) The levels of naturally occurring arsenic and lead in the Wellness dog food diets do not present a health risk to dogs.

D) The concentrations of arsenic and lead in the Wellness dog foods fall within ranges that have been reported in the scientific literature in numerous pet food samples and are comparable to those seen in other fish-based dog foods. Detected levels also are well below the concentrations that have been determined to be associated with adverse effects by experts and regulatory agencies with oversight of pet foods.

E) Based upon a conservative, theoretical, worst-case BPA exposure assessment using current scientific information, the amount of BPA reportedly found in the Wellness

[1] I reserve the right to change, modify, or add to this Report, should Plaintiff set forward any additional or alternative benchmarks or standards as to metals or other toxins at issue. Furthermore, should Plaintiff present expert opinions pertaining to these subject matters or related subject matters, I reserve the right to conduct additional work and analysis, and if appropriate, to offer rebuttal expert opinions.

products is an infinitesimal fraction (far less than one-tenth of one percent) of the lowest available animal derived no observable adverse effect level (NOAEL), and thus well below any level that might cause harm to a dog.

7. **ARSENIC AND LEAD:**

Arsenic and lead are naturally occurring substances that are widely distributed in the environment. Their distribution can be influenced by human activities (e.g., mining, manufacturing, fossil fuel combustion) or through natural geological processes (e.g., weathering or volcanic eruptions). Below is a brief summary of the toxicity associated with both elements.

a. Arsenic

Arsenic is a naturally occurring element that is widespread in the environment and can be found in rocks, soil, water, and foods (i.e., seafoods, grains such as rice, fruits, and vegetables; *see* http://www.fda.gov/Food/FoodborneIllnessContaminants/Metals/ucm280202.htm). DeClementi (2013) suggests that it is impossible for animals to avoid exposure to natural sources of arsenic given its ubiquitous nature. Arsenic can be found in both inorganic and organic forms and the form influences its potential toxicity. Organic arsenic, such as arsenobetaine (AsB), is the form found mainly in fish and other seafood and is essentially non-toxic (Kelly *et al*. 2013). Acceptable intakes of arsenic (i.e., Reference Doses or RfDs established for human intakes) are defined for inorganic forms of arsenic, which are not typically present in pet foods (Kelly *et al*., 2013). Arsenic might be an essential (required) mineral for humans (and other animals) at low concentrations, although its essential role in maintaining health is not completely clear (NRC, 2005).

When assessing toxicity, the importance of the form of arsenic can't be overstated. A recent review of different forms of arsenic in seafood consumed by humans confirmed that AsB is the predominant form of arsenic in seafood and the principal dietary source of arsenic exposure for humans (Luvonga et al., 2020). AsB is considered to be non-toxic with an acute oral lethal dose 50 (a dosage capable of causing lethality in 50% of the individuals given the chemical) of greater than 10,000 mg/kg body weight.[2] Contrast these doses of organic forms of arsenic with the acute oral lethal doses of inorganic arsenic ranging between 15 and 42 mg/kg body weight. As one example of the low toxicity of organic forms of arsenic to mammals, a wild sheep species on the island of North Ronaldsay is known to exclusively consume over their lifetimes seaweeds containing up to 74 mg of arsenic, as organic arsenic, per gram of dry matter without ill effects (Hansen, 2002). Seventy-four mg of arsenic per gram is equivalent to an arsenic concentration of 74,000 ppm. Another organic arsenical, roxarsone, was previously used as a feed additive in poultry production. Mice were fed diets containing 57 ppm arsenic in the form of roxarsone for two years (mouse lifetime) with no significant toxic effects noted (NTP, 1989). The testing Plaintiff relies on identified the amount of total arsenic in the dog food and did not differentiate between organic and inorganic arsenic. Dr. Pusillo also failed to address this important distinction.

Arsenic intoxication is now rare in animals due to the decreased use of arsenic compounds as therapeutic agents (i.e., heartworm treatment in dogs), pesticides, livestock feed additives, and

[2] If a lethal dose 50 is given as "greater than" this means that it was the highest dosage tested and therefore the actual lethal dose 50 could potentially be much higher.

wood preservatives. The Committee on Mineral and Toxic Substances in Diets and Water for Animals (MTSA Committee) of the National Research Council (NRC) (see section 10a below) concluded that "chronic oral arsenic toxicosis in domestic animals is seldom reported. The reason for this may be the fact that arsenic is relatively nontoxic to domestic animals." No cases of acute (sudden) or chronic (long-term) arsenic poisoning in dogs or cats as a result of pet food consumption were found following a search of the PubMed database (an NIH supported resource) as of July 2020.

When arsenic intoxication does occur, it is most often due to acute exposure to inorganic arsenic salts (e.g., arsenic trioxide or sodium arsenite) from non-food sources. Signs of acute inorganic arsenic poisoning are usually sudden and severe, typically developing within a few hours. Arsenic poisoning has major effects on the gastrointestinal (GI) tract and cardiovascular systems. Loss of blood and circulatory shock can occur. Large amounts of watery diarrhea, sometimes tinged with blood, are characteristic, as are severe abdominal pain, dehydration, weakness, depression, weak pulse, and collapse of circulation. Many of these signs are non-specific in nature and can be caused by a variety of illnesses. Thus, a diagnosis of arsenic exposure or intoxication requires testing of appropriate biologic samples (e.g., blood or urine from a live individual or liver or kidney from a dead individual) for its presence.

In humans, adverse health effects from chronic exposure to arsenic include skin pigmentation changes, skin lesions, hyperkeratosis on the palms and soles of the feet, and cancers of the skin, bladder and lungs. Other adverse health effects include developmental defects, diabetes, and pulmonary and cardiovascular disease (World Health Organization, https://www.who.int/news-room/fact-sheets/detail/arsenic). Again, a diagnosis of arsenic exposure/intoxication requires testing of appropriate biologic samples.

b. Lead

Lead is a naturally occurring metallic element distributed throughout the environment. It is found in many different forms (elemental lead, inorganic lead salts, and organic forms). The toxicity of lead varies depending on its form. Lead poisoning, a condition in which increased levels of the metal lead are found in blood, can afflict both humans and animals following either acute or chronic exposure to the metal. Lead is a non-essential metal.

Lead poisoning is relatively uncommon in dogs and cats today due to the removal of many sources associated with significant environmental lead exposure (e.g., paint). No reports were found following a July 2020 search in the PubMed database for dogs or cats that described lead intoxication from the ingestion of constituent components of a pet food (e.g., use of beef, chicken or seafood as part of the formulation).

The signs of lead poisoning primarily relate to effects on the GI and central nervous systems (CNS). GI signs such as vomiting and diarrhea are more common with chronic and low-level exposure, whereas CNS symptoms such as hysteria, blindness and seizures are more common with acute exposures of young animals. Other common signs include anorexia, lethargy, abdominal pain, regurgitation, weakness, behavior changes, and anemia. Many of these signs are non-specific in nature and can be caused by a variety of illnesses. Thus, a diagnosis of lead

exposure/intoxication requires testing of whole blood from a live animal or liver/kidney samples from a dead animal for lead.

8. **TESTING PERFORMED ON WELLNESS DOG FOODS**

Lead and arsenic testing conducted at WellPet's request by Midwest Laboratories on various ingredients used in the Wellness dog foods did not detect either metal above the analytical reporting limits of 5 ppm (lead) and 10 ppm (arsenic). (Kean Declaration ¶¶ 36-37; Plaintiff's Motion for Class Certification, Exhibits 11-14, 17-23; Midwest Laboratories Reports). These limits are below regulatory guidance thresholds established by the NRC (2005) and followed by the FDA to inform their decision-making with regard to pet food safety.[3]

Additional testing performed by other laboratories on the three Wellness products in 2017 and 2018 are summarized in **Table 1**.[4]

Table 1

	Wellness Complete Health Grain Free Adult Whitefish and Menhaden Fish Meal Recipe	Wellness Complete Health Adult Whitefish and Sweet Potato	Wellness Core Ocean Whitefish, Herring Meal, and Salmon Meal Recipe
Chemical Solutions (6/12/2017 and 6/7/2017)			
Arsenic	1.2 ppm		1.5 ppm
Lead	0.22 ppm		0.21 ppm
Ellipse Analytics (1/10/2018 and 2/13/2018)			
Arsenic	1.44 ppm to 1.51 ppm	1.12 ppm	1.10 ppm
Lead	0.20 ppm to 0.22 ppm	0.28 ppm	0.186 ppm

[3] Dr. Pusillo suggested that metal testing done by WellPet was not reliable because duplicate samples were not submitted to a second analytical laboratory to confirm the detected concentrations by the first analytical laboratory. However, Plaintiff has not provided any comparison results for the testing performed by Chemical Solutions, Ellipse Analytics, or Iowa State University.

[4] These results are listed in Appendix B of Dr. Pusillo's report.

Iowa State Veterinary Diagnostic Laboratory (6/4/2019)			
Arsenic	0.62 ppm	0.75 ppm	0.77 ppm
Lead	0.29 ppm	0.27 ppm	0.31 ppm

9. **STUDIES ON ARSENIC AND LEAD IN PET FOODS:**

Given the widespread presence of arsenic and lead in our environment through both natural processes and human activities, it is not unusual to find these elements in soils, plants, and human and animal foods. Therefore, it is not unusual to find them in pet foods, such as the Wellness products, which contain high inclusions of fish in their formulas. Several studies in the peer-reviewed scientific literature have examined the concentrations of metals in pet foods.

a. Atkins *et al.*

Atkins *et al*. (2011) measured the concentrations of metals, including arsenic and lead in 58 dog and cat foods (31 dry pet food and 27 wet pet food samples) by inductively coupled plasma-mass spectrometry (ICP-MS). Samples were processed by cryogenic grinding and results were reported on a wet weight basis (as µg/kg).[5] As discussed later in this report, FDA criticized this study as having significant methodological flaws related to the interpretation of the significance of the data and not the data itself (see section 10b below). **Table 2** shows the ranges of the metals found in 18 dry dog food diets in the Atkins study, with all measurements converted to mg/kg, or parts per million (ppm).[6]

Table 2: Ranges of metal concentrations found in 18 dry dog foods by Atkins *et al*. (2011).

[5] Wet weight refers to analyzing a sample (e.g., a pet food) as is without considering the sample's moisture content. Dry weight refers to the sample after it has been dried to a constant weight (e.g., removing all of the moisture from the sample). If the moisture content of the sample is known, analyte concentrations can be converted between wet weight and dry weight using the following formula: dry weight = wet weight x 100/(100-moisture percentage). Given the relatively low moisture content of dry kibble food (approximately 8%), it is not material whether metals (or other chemicals of interest) are measured on a wet or dry weight basis.

[6] 1 microgram (µg/kg) = 0.001 milligram (mg/kg). To convert micrograms (µg/kg) to milligrams (mg/kg), one needs to move the decimal point three places to the left. Milligrams per kilogram is equivalent to parts per million (ppm) and micrograms per kilogram is equivalent to parts per billion (ppb). For ease of comparison, this report will convert measurements of mg/kg and µg/kg to ppm and ppb, respectively.

	Arsenic (ppm)	Lead (ppm)
Dry Dog Food N = 18	0.0304 to 0.248	0.070 to 0.933

b. Kelly *et al.*

Kelly *et al*. (2013) assessed the elemental composition in 18 dry dog food samples from the Atkins study using two different sample digestion techniques (nitric acid and simulated gastric acid digestions). Results were reported on a dry weight basis as µg/kg (ppb). **Table 3** shows the maximum concentrations, using nitric acid digestion, of arsenic and lead in the Kelly study, with all measurements converted to ppm (mg/kg).

Table 3: Maximum concentrations found in 18 dry dog foods by Kelly *et al*. (2013).

	Arsenic (ppm)	Lead (ppm)
Dry Dog Food N = 18	0.79	0.32

The authors concluded that elemental concentrations in dog food "clearly demonstrate a consistency with acceptable levels in animal feedstuff." The Kelly concentrations are approximately the same as the concentrations reported in **Table 1** for the Wellness dog foods.

c. Paulelli *et al.*

Paulelli *et al*. (2018) determined the heavy metal concentrations in dry and canned cat and dog foods, testing 76 dry pet foods (62 dry dog foods and 14 dry cat foods from 43 brands) and 12 canned pet foods (6 canned dog foods and 6 canned cat foods from 5 brands) purchased in Brazilian supermarkets. While not explicitly stated, the concentrations provided are believed to be expressed on a wet weight basis.[7] Another unknown is how Brazilian pet food ingredients differ from those used in the U.S., although similar ingredients are likely utilized. **Table 4** shows the ranges of the metals found in the dry dog food diets in the Paulelli study, measured in ppm (mg/kg).

[7] Although sometimes difficult to determine from published studies whether heavy metal concentrations were expressed on a wet weight or dry weight basis, dry kibble dog foods have relatively low moisture content and, therefore, wet weight vs. dry weight concentrations generally would not vary by more than 8 to 10%. This difference would not alter conclusions based upon the studies included in this report.

Table 4: Ranges of metal concentrations found in 62 dry dog food samples by Paulelli *et al*. (2018).

	Arsenic (ppm)	Lead (ppm)
Dry Dog Food N = 62	0.07 to 0.9	0.06 to 1.4

d. Kim *et al*.

Kim *et al*. (2018) tested 51 dry dog foods that varied with regard to the primary meat source (*i.e.*, fish, red meat [beef, pork, venison or bison] or poultry [chicken, turkey or duck]) for arsenic and lead. The authors did not report metal concentrations found in the various pet food samples, but normalized the concentrations based upon the respective caloric contents of the foods (*i.e.*, the authors reported metal concentrations as milligrams of metal per megacalorie – mg/Mcal).

In order to compare metal concentrations from this study to other cited studies, it was necessary to convert mg/Mcal to mg/kg food. To do so, it was assumed that each kg of food contained 4,000 kilocalories (Kcal). One Mcal = 1,000 Kcal. Thus, one mg/Mcal, as reported by the authors, would be equivalent to one mg per 0.25 kg of food. Therefore, to convert Kim *et al.*'s concentration ranges for the different foods into mg/kg would require their concentrations to be multiplied by 4. **Table 5** sets forth the concentrations of metals measured in ppm (mg/kg).[8]

Table 5: Ranges of metal concentrations found in dry dog foods by Kim *et al*. (2018).

Protein Source	**Number of Products Tested**	**Arsenic (ppm)**	**Lead (ppm)**
Fish	17	0.10 to 4.416	0.072 to 1.3
Red Meat	17	0.028 to 0.536	0.128 to 6.484
Poultry	17	0.028 to 0.532	0.076 to 1.22

The authors concluded that the primary protein ingredient(s) used in the pet food formulation affects the concentrations of arsenic and lead present in the dog food, and specifically noted that fish-based diets were most likely to have higher concentrations of arsenic. The study

[8] While not explicitly stated by the authors, it is believed that the results are reported on a wet weight basis. However, moisture contents for the tested food samples were not provided. Whether the measurements were taken on a wet or dry basis would not alter conclusions based upon the studies included in this report.

further concluded that even though dogs might be exposed to higher levels of heavy metals than humans, it does not indicate a higher risk of toxicity from pet foods because levels are well below chronic exposure levels associated with adverse health effects.

Table 6: Comparison of fish-based diets in Kim *et al*. to the Wellness fish-based diets.

Product tested	**Arsenic (ppm)**	**Lead (ppm)**
Fish-based diets in Kim *et al.*	0.10 to 4.416	0.072 to 1.3
Wellness Complete Health Grain Free Adult Whitefish and Menhaden Fish Meal Recipe	0.62 to 1.51	0.20 to 0.29
Wellness Complete Health Whitefish and Sweet Potato	0.75; 1.12	0.27; 0.28
Wellness Core Ocean Whitefish, Herring Meal, and Salmon Meal Recipe	0.77 to 1.5	0.19 to 0.31

Table 7 sets forth the levels of arsenic and lead in specific competitor fish-based diets for dogs, expressed on a wet weight basis.

Table 7: Arsenic and Lead Measured in Competitor Fish-Based Dog Foods by Third-Party Laboratories.[9]

Competitor Diet Tested	**Arsenic (ppb)**	**Lead (ppb)**	**% Moisture**
Acana Wild Atlantic with Wild-Caught New England Fish & Fresh Kentucky Greens	3530	415	
Blue Buffalo, Wilderness Denali Dinner: Salmon, Venison, Halibut	773	291	6.41
Blue Buffalo, Life Protection Formula, Fish and Brown Rice	669	227	6.72
Earthborn Natural, Holistic-Grain Free, Coastal Catch-Herring, Salmon and Whitefish	1030	290	5.48
Holistic Select Adult Health Anchovies, Sardine, and Salmon	714	106	4.94

[9] The laboratories used to generate this data were Eurofins (https://www.eurofins.com/) and Marshfield Food Safety LLC (acquired in 2017 by ALS Limited; https://www.alsglobal.com/en-us/locations/americas/north-america/usa/wisconsin/marshfield-food), which are reputable accredited food testing laboratories whose results I would rely on during the conduct of my ordinary practice as a veterinary toxicologist.

Merrick, Back Country-Raw Infused, Pacific Catch - Salmon, Whitefish, and Trout	699	184	7.72
NutriSource Grain Free Dry Seafood Select	885	277	7.03
Orijen Six Fish	3360	46	
Taste of the Wild, Pacific Stream	1080	5850	8.38

e. WellPet's Safe Levels of Arsenic and Lead Are Comparable to Those in Competitor Dog Foods.

As **Table 6** and **Table 7** demonstrate, the levels of arsenic and lead in the Wellness dog foods are similar to those present in competitor dog foods available in the market.

By way of example, Kim *et al*. (2018) tested 51 dry dog foods for arsenic and lead. The dog food brands, and number of diets of each brand, tested included: Nestle-Purina (4), Zignature (4), Natural Balance (3), Wellness (3), IAMS (2), Rachael Ray (2), FirstMate (2), Wild Calling (2), Nutro (2), Merrick (2), Blue Buffalo (2), Diamond (2), Annamaet (1), Holistic Select (1), EVO (1), KASIKS (1), Holistic Blend (1), Farmina (1), Dr. Tim's (1), Orijen (1), Acana (1), South Star (1), American Natural Premium (1), California Natural (1), Tuscan Natural (1), Pedigree (1), Royal Canin (1), American Journey (1), Go! (1), Instinct (1), Ol' Roy (1), AvoDerm (1), CANIDAE (1), Canine Caviar (1). Kim *et al.*'s results are reproduced in **Table 5**, above.

The *Kim et al.* results confirm that nearly every dog food available on the market contains some amount of arsenic and lead. They also demonstrate that the amounts of arsenic and lead found in the Wellness products fall within the *Kim et al.* ranges.

f. Summary of Peer-Reviewed Literature

A review of the available peer-reviewed scientific literature clearly shows that arsenic and lead are naturally present in most pet foods, and WellPet's concentrations of arsenic and lead are safe and well within the ranges reported in the literature.

10. **REGULATORY AGENCY DISCUSSION REGARDING HEAVY METALS IN PET FOODS:**

a. The National Research Council's Mineral Tolerance of Animals

In 2003, the FDA asked the National Academies of Sciences (NAS) to convene a committee of scientific experts to provide recommendations on mineral tolerances and toxic dietary levels for animals in order to prevent the adverse effects of minerals on the health of animals, consumers, and the environment. The NAS is a group of independent scientists with the goal to improve government decision-making and public policy in matters involving science, engineering, technology, and health.

As a result of concerns about the potential chronic health effects posed to dogs and cats (and livestock) from the presence of heavy metals in their foods, the National Research Council (NRC) formed a Committee on Mineral and Toxic Substances in Diets and Water for Animals (MTSA Committee). The MTSA Committee was an independent group of scientists with recognized scientific expertise in the effects of metals on metabolism and the health of animals. The NRC charged the MTSA Committee with conducting a thorough review of the scientific literature on trace elements and macro minerals and making appropriate recommendations. The committee examined the primary literature of peer-reviewed journal publications, along with some government surveys and expert reports. It focused on two main aspects of toxicity effects on animals: the mechanisms of toxicity for each mineral and the maximum tolerable level that will not impair animal health.

Under the sponsorship of the Center for Veterinary Medicine at FDA (FDA-CVM), the MTSA Committee published the *Mineral Tolerances of Animals*, 2nd Edition (2005), which proposed maximum tolerable levels (MTL) for 37 individual metals, for rare earth minerals, for sodium chloride, and for nitrates and nitrites in domestic animal feeds based on indices of animal health after reviewing pertinent information in the scientific literature. (Note that the terms element, metal, and mineral are used interchangeably in this report).

The MTL of a mineral is defined as the dietary level that, when fed for a defined period of time, will not impair animal health or performance. It is highly dependent upon the form of the mineral to which the animal is exposed. Important chemical factors determine the bioavailability of the mineral sources, including the solubility of the mineral compound in the digestive tract, its valence state, and whether the mineral is organic or inorganic. The MTLs recommended by the Committee were based on results from a wide variety of studies across multiple domestic animal species, including dogs and cats. The committee concluded that the MTLs are the appropriate comparators for animal diets and physiology rather than the acceptable limits for people developed by the Environmental Protection Agency (EPA) and the World Health Organization (WHO).[10] The MTLs applied to all dogs irrespective of age, weight, or physiologic status (e.g., reproductive status).

The dietary MTLs, in dry weight, are 12,500 µg/kg or 12.5 mg/kg for arsenic, and 10,000 µg/kg or 10 mg/kg for lead. (NRC, 2005). It is important to note that the *Mineral Tolerance of Animals*, 2005, gives a total dietary arsenic MTL across species of 30 mg/kg (ppm), but notes a non-toxic dietary concentration in rats of 12.5 mg/kg (ppm). The FDA's Target Animal Safety Review (2011) used a more conservative MTL of 12.5 mg/kg for their evaluation since rats were considered to be the species most sensitive to arsenic. Thus, the FDA has at times used a lower, more conservative threshold for pet foods without identifying a health risk for dogs or cats.

b. FDA's Target Animal Safety Review Memorandum

Due to concerns about the relevance to health of the measured concentrations noted by Atkins (2011), FDA's CVM critically reviewed the conclusions of the Atkin's Part II paper and

[10] Plaintiff's complaint references exposure limits set by EPA for humans and other limits proposed by FDA for humans.

determined that the measured concentrations did not present an adverse health risk to pets and, in fact, the concentrations present were only a fraction of acceptable dietary intakes based upon the conclusions of the MTSA Committee in the *Mineral Tolerances of Animals*, 2nd Edition (2005). *See Target Animal Safety Review Memorandum*, http://www.fda.gov/downloads/AboutFDA/CentersOffices/OfficeofFoods/CVM/CVMFOIAElectronicReadingRoom/UCM274327.pdf.

The FDA Target Animal Safety Review authors faulted the Atkin's paper for "the selection of the EPA RfD and WHO PTDI values[11] for humans for comparison and judging whether the calculated exposures are excessive and problematic for dogs or cats." Atkins *et al*. justified the use of those two human health benchmarks because the FDA had not developed tolerable limits for trace metals in pet food. The FDA Target Animal Safety Review authors responded:

> It is true that FDA has not promulgated guidance, action levels, or tolerances for maximum content in feeds for the 15 elements measured and discussed in the manuscripts. The specific 15 elements measured in the Atkins *et al*. studies, as well as other elements in the periodic table, may be naturally occurring constituents of feeds and feed ingredients. The Federal Food, Drug, and Cosmetic Act (the Act) requires that the amount of a poisonous or deleterious substance that is itself not directly added to food, but rather is a constitutive component of food, needs to be present in an amount that ordinarily renders the product injurious to health before the food can be considered adulterated and actionable under the prohibitions of the Act. To meet this adulteration standard for elements present in animal feeds, including pet foods, the FDA considers the information and recommendations of the National Research Council of the National Academies (NRC) Committee on Minerals and Toxic Substances in Diets and Water for Animals (MTSA Committee) as published in Mineral Tolerance of Animals Second Revised Edition, 2005.

By way of the Target Animal Safety Review, the FDA approved of and adopted the NRC's MTLs and even used a more conservative total arsenic threshold for their evaluation of risks to pets.

The MTLs established by the NRC and used by the FDA are the best and most widely used scientific guidance available to veterinary toxicology and nutrition experts for determining what are safe levels of heavy metals in dog food. I frequently rely on the MTLs in my practice as a veterinary toxicologist.

c. EU Directive (2002/32/EC)

In 2002, the European Union (EU) proposed regulations for safe upper limits of arsenic and lead in pet foods. This was prior to the publication of the *Mineral Tolerances of Animals*, 2nd Edition (2005). The EU amended this directive most recently in November 2019. The current EU

[11] EPA RfD refers to the reference dose used by the Environmental Protection Agency. WHO PTDI refers to the permissible tolerable daily intake values for people set by the World Health Organization.

regulatory limits, measured in mg/kg relative to a feed with a moisture content of 12%, are as follows:

- Arsenic (total): 10 mg/kg
  - Recorded as the limit for "complementary feed for pet animals containing fish," "complete feed for fish and fur animals," and "complete feed for pet animals containing fish."

- Inorganic Arsenic: 2 mg/kg (as set out in footnote 2 of the EU Directive)
- Lead: 10 mg/kg and 5 mg/kg
  - Recorded as the limit for "complementary feed" and "complete feed," respectively.

The concentrations of arsenic and lead identified for the Wellness dog foods are all well below the regulatory limits set by the EU.

As discussed earlier, there is a significant difference in toxicity between inorganic arsenic and organic arsenic. Organic forms of arsenic predominate in ingredients derived from fish and shellfish (Thomas and Bradham, 2016). The predominant organic arsenic form, arsenobetaine or Asb, is relatively non-toxic compared to inorganic forms of arsenic (Luvonga et al., 2020; Thomas and Bradham, 2016; Sakurai et al., 2004). The arsenic in the Wellness dog foods is almost certainly this organic form derived from the included fish ingredients. The EU regulations for pet food allow up to 10 ppm of arsenic in pet foods containing fish because most of the measured arsenic is in an organic form (arsenobetaine or AsB).

My review of heavy metal test results for other fish-based pet foods further supports the above conclusion. Organic arsenic comprised 99%+ of the arsenic in the fish-based pet food tested by Eurofins Laboratory (https://www.eurofins.com/). These results are set forth below in **Table 8**.

Table 8: Organic Arsenic and Inorganic Arsenic Levels Measured in Competitor Dog Foods by Eurofins Lab.

Diet Tested	Organic Arsenic ppm (mg/kg)	Inorganic Arsenic ppm (mg/kg)
Orijen Six Fish	2.82	0.016
Acana Freshwater Fish	0.779	0.010

* * *

Table 9 below shows that the highest levels of arsenic and lead found in the testing of Wellness products relied upon by Plaintiff are far below the NRC/FDA MTLs and EU maximum limits, and thus are safe levels.

Table 9: Comparison of Highest Levels in Plaintiff's Test Results to FDA/EU Limits.

Diet and Heavy Metal Tested	Level Reported (ppm)	NRC/FDA MTL (ppm)	Percentage of MTL	EU Levels in Directive 2002/32/EC (ppm)	Percentage of EU Level
Arsenic Wellness Complete Health Grain Free Adult Whitefish & Menhaden Fish Meal Recipe	1.512[12]	12.5[13]	12.0%	10	15.1%
Lead Wellness Core Ocean Whitefish, Herring Meal & Salmon Meal Recipe	.310	10	3.1%	5	6.2%

The above dietary guidelines for arsenic and lead are specifically tailored to animals and pet foods. As noted in section 10b above, the FDA specifically faulted one study for using human health-based benchmarks to assess the significance of low concentrations of metals in pet foods rather than those established by the MTSA Committee. Thus, when specific guidelines are available for pets, human health-based benchmarks should not be used.

FDA's guidelines for humans are inapplicable to fish-containing pet foods for another reason: FDA's focus is on inorganic arsenic, the kind not generally found in fish. FDA has set arsenic limits for human food only as to inorganic arsenic, and even then, only for infant rice cereal and apple juice. *See Guidance for Industry: Action Level for Inorganic Arsenic in Rice Cereals for Infants* (August 2020), https://www.fda.gov/media/97234/download; *Draft Guidance for Industry, Arsenic in Apple Juice: Action Level* (July 2013), https://www.fda.gov/media/86110/download. FDA has determined that a limit of 100 ppb of inorganic arsenic for infant rice cereal and 10 ppb for single-strength (ready to drink) apple juice is achievable with good manufacturing practices based on sampling and testing of marketed products. Although FDA has set a limit for total arsenic in bottled water at 10 ppb (the same amount allowed by EPA for public drinking water), the

[12] This level was reported by Ellipse Analytics. The arsenic level reported by Iowa State University Veterinary Diagnostic Laboratory for this Wellness product was 0.620 ppm. Pusillo Rep., Appendix B.

[13] For an increased safety margin, I have used the more conservative MTL of 12.5 ppm applicable to rats, which have a known increased sensitivity to arsenic. The MTL NRC established for mammals is 30 ppm.

primary forms of arsenic found in water are inorganic (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#Inorganic).

* * *

In his report on behalf of the Plaintiff, Dr. Pusillo consistently disregards basic tenets of toxicology, including that there are exposure thresholds below which adverse health effects are not expected to occur. Scientifically sound chemical safety testing requires well-designed dosing studies using laboratory animals to establish thresholds such as the no observable adverse effect level (NOAEL) and lowest observable adverse effect level (LOAEL) for chemicals. Experts then develop health-based parameters using this information and apply significant safety factors to set safe exposure limits. Thus, it simply is incorrect to state categorically that there are no safe levels of exposure to arsenic and lead.

The ability to detect a chemical at low concentrations does not translate into an increased risk of an adverse health effect. What is critical is to be able to detect a chemical near a regulatory or health-based threshold, not at a concentration an order of magnitude greater than or below the threshold. Likewise, human health-based thresholds cannot automatically be applied to other species. In fact, human health-based thresholds use safety factors (e.g., 10X or 100X) when extrapolating animal derived toxicity data to human threshold values.

Dr. Pusillo improperly concludes that arsenic and lead harm the health of dogs without having considered factors such as the degree of exposure, the form of metal to which dogs are exposed (e.g., organic vs. inorganic forms of arsenic), animal-specific regulatory limits established by experts and regulatory bodies, and in the absence of peer-reviewed literature suggesting that lead and arsenic in pet food is the cause of illness of dogs. Notably, the FDA study Dr. Pusillo cites and attaches to his report (CVM CY15-17 Report on Heavy Metals in Animal Food, 2019), directly contradicts the conclusion that at commonly detected concentrations of arsenic and lead in animal feeds/foods there is a health risk to animals.

Similarly, Dr. Pusillo's belief that alterations of the gut microbiome are associated with adverse health effects is speculative and based on insufficient evidence, as the authors of the study he relies on (Breton et al. (2013)) concede. Breton and colleagues concluded that "further studies are needed to understand the complex crosstalk between gut microbiota and the host, interpret the clinical consequences of exposure to xenobiotics and assess the relationship between the environment and disease susceptibility." Several recent reviews of our current understanding of the role of the gut microbiome on health and disease in people and animals illustrate the promise of increasing our knowledge in this area through well-designed studies, but also the challenges in interpreting data from this emerging area of scientific inquiry (Benson, 2016; Cullen et al., 2020; Qian and Ho, 2020). It is premature to draw any "cause and effect" conclusions from early, single studies that have not been duplicated.[14]

[14] Although Dr. Pusillo also states that arsenic and lead provide no nutritional value, he presents no evidence that the low concentrations detected in pet foods have any effect on the overall nutritional quality of the pet food.

11. **BISPHENOL-A (BPA):**

Bisphenol-A (BPA) is a chemical (a monomer) produced in large quantities for use primarily in the production of polycarbonate plastics and epoxy resins. Polycarbonate plastics have many applications, including use in some food and drink packaging (e.g., water and infant bottles, compact discs, impact-resistant safety equipment, and medical devices). Epoxy resins are used as lacquers to coat metal products such as food cans, bottle tops, and water supply pipes.

The primary source of exposure to BPA for most people is through the diet. (https://www.niehs.nih.gov/health/topics/agents/sya-bpa/index.cfm). Bisphenol A can leach into food from the protective internal epoxy resin coatings of canned foods and from consumer products such as polycarbonate tableware, food storage containers, water bottles, and baby bottles. However, BPA is also present in our air, dust, and water. For example, Rudel *et. al* (2001) tested residential and office dust samples, as well as air samples, through gas chromatography/mass spectrometry. The study reported an average concentration of 0.38 µg/g (380 ppb) of BPA in dust samples, and BPA levels ranging from 0.002-0.208 µg/m^3 in air samples. Given BPA's ubiquitous presence in our environment, humans and animals are exposed to BPA daily through a variety of pathways.

12. **SCIENTIFIC LITERATURE AND STUDIES ON BPA:**

Because of the ubiquitous presence of BPA in our environment, it is nearly certain that BPA is present in most food products. Several studies in peer-reviewed scientific literature have examined the concentrations of BPA in human and pet foods. The potential health effects of BPA exposure have been extensively studied in a variety of laboratory animal species and the significance of the findings considered by numerous agencies and expert bodies. For example, Camacho et al., (2019) assessed the results of an FDA-sponsored two-year toxicology study of BPA in laboratory rodents. The authors concluded that existing human health-based guidelines are adequate and that adverse health effects of BPA "at the lower end of the dose range tested have not demonstrated a consistent interpretable pattern with biological plausibility."

a. BPA in Human Foods

BPA is commonly found in human foods. Noonan *et al.* (2011) measured BPA in 78 canned and two frozen food samples representing 16 different food types that are frequently consumed. BPA was detected in 71 of the 78 canned foods but not detected in the frozen food samples. Concentrations in the canned foods ranged from 2.6 to 730 µg/kg (2.6 to 730 ppb).

BPA is even found in breast milk and the dairy supply chain. Mercogliano and Santonicola (2018) showed that human breast milk and commercial milk samples contain BPA at concentrations up to 87.7 µg/L (87.7 ppb) and 521 µg/L (521 ppb), respectively.

b. BPA in Pet Foods and Pet Products

Other studies have measured BPA concentrations in canned pet foods. Kang and Kondo (2002) found BPA concentrations in pet foods that ranged from 13 to 136 µg/kg in cat food (N = 15) and 11 to 206 µg/kg in dog food (N=11). Koestrel *et al.* (2017) measured BPA concentrations

in serum samples in dogs (N=14) fed one of two canned dog foods. The mean concentrations measured in the pet foods were 11.8 +/- 4.3 µg/kg for diet A and 18 +/- 3.6 µg/kg for diet B. Measurable differences in BPA serum concentrations were noted between the baseline diet (dry dog food in bags) and an experimental diet (A or B) fed for two weeks (0.7 +/- 0.15 µg/kg vs. 2.2 +/- 0.15 µg/kg). While the authors noted changes in plasma bicarbonate concentrations and fecal bacterial species from baseline values, no adverse health effects were observed. While the authors did note some gut microbiome changes over the two-week course of the study, they could not conclude that the noted changes were due to BPA since it was equally plausible that changes could have been due simply to dietary changes.

Wooten and Smith (2013) determined the potential exposure of dogs to BPA (and phthalates) via canine toys and training devices using an *in vitro* system. Study results confirmed that toys and training devices are potential sources of exposure to both BPA and phthalates. However, no conclusions related to the risk of adverse health effects to dogs were provided.

c. Studies on the Effects of BPA on Animals

While most BPA toxicity studies use rodents (i.e., rats or mice) to derive no observable adverse effect levels (NOAELs), according to the FDA's 2008 Draft Assessment of Bisphenol A for Use in Food Contact Applications, Wazeter and Goldenthal (1976) conducted a sub-chronic study on BPA using Beagle dogs to assess oral toxicity of the chemical. This study was not published in the peer-reviewed literature and complete details are not available. However, according to the FDA, it was a 90-day dietary study at dose levels of 0, 1000, 3000 or 9000 ppm in the diet (0, 25, 75 or 225 mg/kg per day). The only potentially adverse effect noted was an increase in relative liver weight at the highest dose level (an increased liver weight is not always considered an adverse effect), according to the FDA. Tissues from dogs receiving 9000 ppm (225 mg/kg per day) of BPA in the diet were examined histopathologically and no treatment-related effects were noted. The NOAEL in this study was determined to be 74 mg/kg/ bw (body weight) per day, or 74,000 µg/kg/ bw per day.

d. BPA Concentrations in the Wellness Dog Foods

Ellipse Analytics tested select WellPet Dog foods for BPA. BPA was detected at 174.4 ppb and 132.7 ppb in samples of Wellness Complete Health Adult Whitefish and Sweet Potato and Wellness Core Ocean (Whitefish, Herring and Salmon Meal Recipe), respectively. According to the testing records provided by Ellipse, the lab tested at least three samples of each product. The BPA amounts identified for the other two samples of Sweet Potato were 55 ppb and "ND" (not detected). The BPA amounts for the other two samples of CORE Ocean were 58.5 ppb and ND.[15] Neither Dr. Pusillo nor Dr. Callan referenced these lower amounts in their reports.

13. **BPA EXPOSURE ASSESSMENT**

Based upon the limited toxicity information specific to dogs, exposure to BPA from the Wellness dog food formulations is minimal and would not have an adverse health effect. For the

[15] *See* CALLAN000079, 000090, 000179, 000188.

sake of argument, even a much lower NOAEL of 5000 µg/kg/day (5 mg/kg/day) derived from well-designed rodent studies (https://www.fda.gov/media/90124/download) would not be expected to cause an adverse effect. Taking the highest BPA concentration reported by Plaintiff of 174.4 ppb and following label directions on the recommended amount of that product for daily feeding (recommended number of cups of kibble at 120 grams of kibble per cup for a given weight range), one can calculate a daily BPA intake.[16] Because of increased food intake in smaller dogs due to increased metabolic demand, calculating a daily intake for a small dog is a conservative approach to exposure assessment. For example, a 15 lb. (6.82 kg) dog eating Wellness Complete Health Adult Whitefish and Sweet Potato would consume 1 cup or 120 grams of kibble per day. The 120 grams of kibble would contain 20.9 µg of BPA[17] and the daily dose of BPA would be 3.06 g/kg/bw of BPA. This would be 0.061% of the 5000 µg/kg/day NOAEL. For a 125 lb. dog (56.8 kg), 640 grams of kibble (the maximum daily amount recommended) would contain 111.62 µg of BPA, resulting in a daily BPA dose of 1.97 µg/kg/bw, or approximately 2/3 the dose of the smaller dog. This value is only 0.04% of the NOAEL. Using an uncertainty factor of 10 for extrapolating from one species (rodent/mice) to dogs still provides a large margin of safety (0.61% and 0.40% of the NOAEL).[18]

Dr. Pusillo does not identify any studies showing that these extremely low levels of BPA are harmful to dogs. As with arsenic and lead, he fails to apply basic toxicology principles of dose and duration and disregards exposure thresholds. Instead, Dr. Pusillo again focuses on studies that identified certain changes in the gut microbiome in dogs (Koestel et al. (2016)). Although it is true that serum BPA concentrations increased over the 14-day feeding study and qualitative changes were noted in gut bacteria, Koestel and colleagues could not conclude that the changes in gut bacteria were due to BPA or were even harmful to health. It is just as likely that differences were merely due to a change in diet (the two diets fed for the 14 days were different and both differed from the pre-study diet). In addition, changes in several clinical parameters that were statistically correlated with BPA serum concentrations still fell within normal ranges for dogs (i.e., the changes could not be considered adverse effects). As stated earlier, the role that the gut microbiome plays in human and animal health is an emerging area of scientific study whose significance is still not yet understood.

Dated: September 10, 2020

Robert Poppenga, DVM, PhD, DABVT

[16] For purposes of this calculation, I'm assuming that the amount of BPA throughout the bag of dog food remains constant at 174.4 ppb, the same amount reported for the highest sample tested. As the other two samples for this same product show, however, the amounts of BPA in other portions of the bag may be considerably lower or even below detectable limits. Thus, using 174.4 ppb is a conservative approach to exposure assessment.

[17] This is calculated as follows: 174.4 µg/kg equals 0.1744 µg per gram, and 0.1744 multiplied by 120 equals 20.9.

[18] This percentage equates to about 4 to 6 out of 10,000.

EXHIBIT A

CURRICULUM VITAE

Revised June, 2020

Name

Robert H. Poppenga, D.V.M., Ph.D.
Diplomate, American Board of Veterinary Toxicology

Contact Information

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Education

1971 to 1974: Western Illinois University, Macomb, IL. No degree earned prior to acceptance to veterinary school.

1974 to 1978: University of Illinois at Urbana-Champaign, IL, College of Veterinary Medicine, D.V.M.

1982 to 1985: University of Illinois at Urbana-Champaign, IL, College of Veterinary Medicine, Veterinary Toxicology Residency

1982 to 1987: University of Illinois at Urbana-Champaign, IL, College of Veterinary Medicine, Ph.D.

Dissertation: Effect of Therapeutic Intervention on Pathophysiology, Pathology, and Survival in Rats and Swine Following Acute Intravenous Exposure to T-2 Toxin.

Chronology of Academic Employment

2005 to Present: Professor of Clinical Veterinary Toxicology, Step 6, University of California at Davis, School of Veterinary Medicine, Department of Molecular Biosciences and Head, Toxicology Section, California Animal Health and Food Safety Laboratory (CAHFS).

As Head of the Toxicology Section of CAHFS, I directly or indirectly supervise 13 FTEs. I am responsible for establishing Section policy and strategic goals and overseeing the evaluation of all Section staff with the exception of one faculty veterinary toxicologist. The annual state budget for the Section is approximately $1,200,000. The Section has also been an important participant in the FDA/USDA's Food Emergency Response Network (FERN) and is the only veterinary laboratory funded as part of the program. I have been responsible for extramural support for the Section of approximately $2,600,000 in monetary support and $1,200,000 in equipment support since 2005 (via the FERN program). During my tenure as Section Head, the Laboratory has also received approximately $700,000 in CA Homeland Security funding. The CAHFS Toxicology Section is the premier diagnostic toxicology laboratory in North America and provides services unavailable elsewhere. Our veterinary toxicology residency program is one of only 2 or 3 programs of its type in North America. Although our focus is on animal diagnostic and forensic toxicology, we are frequently called on to assist with human forensic investigations.

2005: Professor of Toxicology, Clinician-Educator Track, University of Pennsylvania, School of Veterinary Medicine, Department of Pathobiology and Chief, Pennsylvania Animal Disease Laboratory System at New Bolton Center's Toxicology Laboratory.

1998 to 2004: Associate Professor of Toxicology, Clinician-Educator Track, University of Pennsylvania, School of Veterinary Medicine, Department of Pathobiology and Chief, Pennsylvania Animal Disease Laboratory System at New Bolton Center's Toxicology Laboratory.

1993 to 1997: Assistant Professor of Toxicology, Clinician-Educator Track, University of Pennsylvania, School of Veterinary Medicine, Department of Pathobiology and Chief, Pennsylvania Animal Disease Laboratory System at New Bolton Center's Toxicology Laboratory.

At the University of Pennsylvania, I was responsible for establishing a diagnostic toxicology laboratory service where one had not existed before as part of the Pennsylvania Animal Health Laboratory System. I supervised 3 FTEs and managed an annual budget of approximately $400,000.

1987 to 1993: Assistant Professor, Michigan State University, College of Veterinary Medicine; joint appointment in the Department of Pharmacology and Toxicology (1987 to 1991), the Department of Pathology (1991 to 1993) and the Animal Health Diagnostic Laboratory.

Other Relevant Employment

Following receipt of my D.V.M. degree in 1978, I was engaged in small animal private veterinary practice in the St. Louis, MO and Springfield, IL areas until 1982 when I returned to the University of Illinois to purse a Ph.D. in veterinary toxicology.

Statement of Interest

My current focus is veterinary clinical and diagnostic toxicology. Areas of interest within clinical and diagnostic toxicology include wildlife toxicology, development of biomarkers of exposure to environmental contaminants and, more recently, issues related to the safety of foods and feeds (both human and animal) from a chemical contamination perspective. In addition to my involvement in the Food Emergency and Response Network (FDA-USDA program), my laboratory is an active participant in the Veterinary Laboratory Response Network (FDA program).

Awards and Honors

1972 Alpha Zeta: agricultural scholastic honorary
1972 Phi Kappa Phi: scholastic honorary
1985 Phi Zeta: veterinary scholastic honorar2013 American Board of Veterinary Toxicology Service Award

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Licensure and Specialty Certification

Illinois Veterinary Medical License (Inactive)
Missouri Veterinary Medical License (Inactive)
Michigan Veterinary Medical License (Current)
Diplomate, American Board of Veterinary Toxicologists, 1988

External Academic and Administrative Services

2017-2019:	Morris Animal Foundation, Golden Retriever Lifetime Study, Scientific Steering Committee
2016 – Current:	Organizing Committee for the CA Center for Parks and Protected Areas Leadership
2016 – 2018:	National Water Research Institute, Independent Advisory Panel for the CA State Water Resources Control Board to Determine Potential Risks of Using Tertiary Recycled Water for Consumption by Animals
2016 – Current:	Morris Animal Foundation Grant Review (Wildlife)

2001 – 2004:	Adjunct Appointment, Cornell University, School of Veterinary Medicine (teaching veterinary toxicology)
2002 – 2004:	Veterinary Consultant, Children's Hospital of Philadelphia, Poison Control Center
1990 – 1992 and 2002 – 2006:	Participating faculty member for "Envirovet", an intensive summer short course for veterinary students interested in environmental toxicology and aquatic animal medicine with an emphasis on aquatic ecosystems.
1998 to 2003:	PADLS Resident Director's Monthly Meeting, Penn-NBC representative.
1999:	PADLS Fall Diagnostic Conference at NBC, Organizer and Moderator.

Internal Academic and Administrative Service

Michigan State University – list available upon request.

University of Pennsylvania

1994 – 1996:	AV Committee
1996 – 1997:	Committee on Committees
1996 – 1998:	Secretary of the Faculty
1999 – 2002:	Admissions Committee
1996 – 2005:	Farm Show Committee (Chair, 2002)
2002:	Interim Judicial Inquiry Officer
2002 – 2005:	Judicial Inquiry Officer

University of California at Davis

2006 – 2009: School of Veterinary Medicine: Faculty Personnel Committee

2004 – Current: California Animal Health and Food Safety Laboratory System: Section Head, Toxicology Laboratory; Process Improvement Council

2005 - 2008: SVM Curriculum Review Steering Committee (comprehensive review of the SVM veterinary curriculum and formulation of revisions)

2008: Admissions Committee, Master's of Preventive Veterinary Medicine Program, SVM

2010-2012: PTX Graduate Group, Admissions Committee, UCD

2013: SVM Teaching Effort and Recognition Task Force, School of Veterinary Medicine

2013 – Current: Forensic Science Graduate Group, Admissions Committee, UCD

2014 – Current: California Department of Food and Agriculture, Feed Inspection Program, Technical Advisory Sub-Committee

2012 - 2015: FDA Center for Veterinary Medicine, Office of Minor Use and Minor Species, Grant Review Panel

2014 – Current: Oiled Wildlife Care Network, Scientific Advisory Committee, School of Veterinary Medicine

2015 –2016: Strategic Admissions Advisory Committee, School of Veterinary Medicine

2015 – 2018: International Program Committee, School of Veterinary Medicine (appointed Chair in 2016)

2018-Current: Curriculum Committee, School of Veterinary Medicine.

Editorial Positions

1999 to 2011:	Editorial Board – *Journal of Veterinary Diagnostic Investigation*
2001 to 2005:	Editorial Board – *Oriental Pharmacy and Experimental Medicine*
2005 to 2012:	Editorial Board – *Journal of Medical Toxicology, Section Editor for Veterinary Toxicology*
Ad hoc reviewer for:	*Toxicon, Journal of Regulatory Toxicology, Journal of Natural Products, Standards of Care, Journal of Zoo and Wildlife Medicine, Equine Veterinary Journal, Critical Reviews in Toxicology, Journal of Wildlife Diseases, Human Ecology, Environmental Toxicology, Journal of Veterinary Emergency and Critical Care, Journal of Emergency Medicine, Australian Veterinary Journal*
Invited Reviews:	U.S. Pharmacopeia, Veterinary Pharmaceutical Information, review of a monograph for methylene blue.
	National Research Council, Board on Agriculture and Natural Resources, review of the report entitled *Safety of Dietary Supplements for Horses, Dogs and Cats* (2008).

Memberships in Professional and Scientific Societies

American Board of Veterinary Toxicology

1993-1999:	Secretary - Treasurer
1999–2003:	President
2006-2009:	Examination Committee (Chair, 2009)
2005-2009:	Long Range Planning Committee

2007-2009:	ABVT representative to the Council on Agricultural Science and Technology
2019 – Current	Education Committee, Chair

American Academy of Veterinary and Comparative Toxicology

1995-1998:	AAVLD/AAVCT Veterinary Analytical Toxicology Advisory Committee
1999-2002:	Councilor
2007-2009:	AAVCT representative to the Council on Agricultural Science and Technology

American Academy of Clinical Toxicology

American Association of Veterinary Laboratory Diagnosticians

1995 and 2001:	Co-Moderator, Toxicology Scientific Session, Annual Meeting
2000 to 2005:	PA Alternate Delegate – House of Delegates
2002 to 2003:	Long Range Planning Committee
2006 - Current:	Executive Committee
2010 – Current	Committee on Environment and Toxicology
	Proficiency Test Subcommittee (2010 – current)
	Mission Statement Subcommittee (2010-2011)

American Veterinary Medical Association

2008 - 2104:	Member, Committee on Environmental Issues (CEI)
2010 – 2012:	CEI Subcommittee on Waste Disposal
2012 – 2014:	Chair, CEI
2010:	National Hazardous Waste Product Database Task Force

International Assembly for the Recognition of Toxicologists (IART)

2002 – 2005:	Secretary – Treasurer

Council on Agricultural Science and Technology

2006-2009:	Animal Science Work Group
2007-2008	Chair, Animal Science Work Group
2008-2009	National Concerns Committee

Sierra Nevada Fisher Working Group (SNFWG)

2012 – Current:	Member
2012 – Current:	Anticoagulant Rodenticide Subcommittee

Society of Environmental Toxicology and Chemistry

Society of Toxicologic Pathologists (currently inactive)

1999-2001:	Membership Committee

Society of Toxicology

1997 to present:	Veterinary Specialty Section
1997-1999:	Veterinary Specialty Section - Councilor for Membership

The International Association of Forensic Toxicologists (currently inactive)

Veterinary Emergency and Critical Care Society (currently inactive)

Other Relevant Experience

1982-1987:	Staff veterinarian for the Toxicology Hotline of the National Animal Poison Control Center, University of Illinois, College of Veterinary Medicine.
1987-1993:	Affiliated with the Institute for Environmental Toxicology, Michigan State University.
1991; 1992:	Participating faculty member for "Safety of Foods of Animal Origin" - summer short course at Michigan State University.
2016:	Member, Physicians Dialogue Group, Monsanto, Creve Coeur, MO
Currently	Affiliated with the Wildlife Health Center, UC-Davis
Currently	Member of the Lead Advisory Group, Humane Society of the United States
Currently	Member, CA Department of Food and Agriculture Livestock Feed Taskforce

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Residents, Graduate Students and Post-Doctoral Fellows

Michigan State University – list available upon request.

University of Pennsylvania

1998 – 1999	Sponsor of Merck Summer Fellowship Student: Patricia Alexander
2004	Sponsor of Merck Summer Fellowship Student and Geraldine R. Dodge Foundation Applicant: Sara Rybolt

University of California at Davis

2005 - 2008	Toxicology Resident: Dr. Asheesh Tiwary
2006 - 2007	M.S. Candidate: Taylor Ludwick
2007 - 2008	Toxicology Resident: Dr. Bimal Chhetri
2008 - 2010	Toxicology Resident: Dr. Motoko Mukai
2008 - 2011	Ph.D. Candidate: Terra Kelly
2010 - 2012	Toxicology Resident: Dr. Snehal Tawde
2012 - 2014	Toxicology Resident: Dr. Adrienne Bautista
2015 - 2017	Toxicology Resident: Dr. Arya Sobhakumari

Serve as mentor to UC-Davis Medical Center Toxicology Fellows who participate in a 2 week rotation through the Toxicology Section of CAFHS.

Research Support

Previous:

Food and Drug Administration ($1,600,000): The use of LC/MS, GC/MS and ICP/MS analysis for the screening and identification of toxic substances in food with an emphasis on animal and grain derived foods and food products, PI, 2005-2010.

Food and Drug Administration ($1,600,000): The use of LC/MS, GC/MS and ICP/MS analysis for the screening and identification of toxic substances in food with an emphasis on animal and grain derived foods and food products, PI, 2011-2015.

Central Valley Project Conservation Program ($386,218): Implementation of Priority 1, Priority 2, and Priority 3 Recovery Tasks for Giant Garter Snake (*Thamnophis gigas*) – Pathology and the role of water quality and contaminants in the distribution, health, and persistence of San Joaquin Valley and Sacramento Valley giant garter snake populations, Co-PI, 2008-2009.

Michigan State University CVM Endowed Research Fund ($24,991): Effect of sorbitol, single, and multi-dose activated charcoal administration on carprofen absorption following experimental overdose in dogs. Co-I, 2009-2010.

Dairy Research Foundation ($90,000): Food Animal/Food Safety Residency Program at CAHFS. Co-PI, 2012-2013.

Central Valley Project Conservation Program ($358,104): Volta Giant Garter Snake Monitoring Project. Co-PI, 2010-2013.

FDA, Center for Veterinary Medicine ($23,701): Historical database of animal feed or drug toxicities. PI, 2011-2012.

Center for Equine Health, ($27,526): Study of Causes and Diagnosis of Sudden Death in Racehorses, Co-Investigator (Uzal, F., PI).

Current:

Food and Drug Administration ($1,600,000): The use of LC/MS, GC/MS and ICP/MS analysis for the screening and identification of toxic substances in food with an emphasis on animal and grain derived foods and food products, PI, 2015-2019.

Submitted: Unfunded

Morris Animal Foundation Pre-Proposal ($78,778): Systemic osteoporosis induced by environmental exposure to silica dioxide, 2007. Co-I.

TSR&TP New Investigator Grant ($97,967): Environmental contamination and mortality in threatened wildlife due to anticoagulant rodenticides, 2007. Co-I.

TSR&TP New Investigator Grant ($202,858): Linking hunting activities to lead exposure and toxicosis in sentinel avian scavenging species. 2008. Co-I.

TSR&TP New Investigator Grant ($79,965): Environmental contamination and mortality in vulnerable bird species due to anticoagulant rodenticides. 2008. Co-I.

TST&TP Student Grant ($60,000): Effects on wild carnivores of bio-accumulating anticoagulant rodenticides. 2008. Collaborator.

Scientific Presentations and Invited Lectures

"Lead and Lead Residues." Michigan Department of Agriculture, Animal Industry Division Meeting, February, 1993.

"Lead Toxicosis in Loons." 58th North American Wildlife and Natural Resources Conference, Washington, D.C., March, 1993. Also, I was an invited participant in a panel discussion of the hazard of lead sinkers to loons.

"Bioavailability of Lead from Site-Specific Mining Waste: An Oral Intubation Study in Young Swine", UC-Davis, Department of Pharmacology and Toxicology, October, 1991.

"Methods for Investigating Suspected Forage-Related Animal Mycotoxicoses", 12th Annual Food Safety Research Program Planning Workshop, sponsored by ARS and FSIS of the USDA, Washington, D.C., December, 1991.

"A Metal Here, A Metal There: So What's the Problem?" Institute for Environmental Studies, University of Pennsylvania, Philadelphia, PA, April, 1996.

"Diagnostic Veterinary Toxicology: From Farm to Ecosystem." School of Veterinary Medicine, Helsinki, Finland, June, 1998.

"Gastrointestinal Decontamination in the Horse." ACVIM Forum, Seattle, WA, May, 2000.

"Approaches to the Measurement of Glomerular Filtration Rate", American Association of Clinical Chemistry, Division of Animal Clinical Chemistry, LabMed 2000, New York, NY, October, 2000.

"The One Medicine Concept: Application to Human and Veterinary Toxicology." Keynote Speaker, 23rd Annual Meeting of the Japanese Society of Clinical Toxicology, Tokyo, Japan, June, 2001.

"Current Issues in Small Animal Toxicology" and "Managing the Suspect Poisoned Patient: Current Approaches to Gastrointestinal Decontamination." Azabu University, School of Veterinary Medicine, Tokyo, Japan, June, 2001.

"The One Medicine Concept: Applications in Veterinary and Human Clinical Toxicology. 13th Ljudevit International Symposium on Comparative Pathology, Zagreb, Croatia, June, 2002. (Abstract published in Acta Clinica Croatica 41(2):157-158, 2002.

"Chemical Agents and the Safety of the Food Supply", Montgomery County Health Department Veterinary Initiative Project, Plymouth Meeting, PA, January, 2004.

"Toxicology Laboratory Update: FERN and CAHFS", Annual Meeting of the Ca Department of Food and Agriculture Milk Inspectors, Sacramento, CA, 2006.

"Amanitin Intoxication: Pathogenesis and Diagnostic Challenges", 60th Annual Meeting of the American College of Veterinary Pathologists, Monterey, CA, December, 2009.

"A Whirlwind Tour of Veterinary Toxicology: A Zoological Facility Focus", 18th Annual Zoo and Wildlife Pathology Workshop, American Association of Zoo Veterinarians, Kansas City, MO, October, 2011.

"When Emergency and Critical Care Medicine Meets Toxicology: Case Management Strategies Part 1", AVMA Annual Convention, Chicago, IL, July 2013.

"When Emergency and Critical Care Medicine Meets Toxicology: Case Management Strategies Part 2", AVMA Annual Convention, Chicago, IL, July 2013.

"Wildlife Toxicology From a Diagnostic Laboratory Perspective", Western University of the Health Sciences, School of Veterinary Medicine, Pomona, CA, Sept. 2013.

"Interesting Wildlife Toxicology Cases from the CAHFS' Archives", Western University of the Health Sciences, School of Veterinary Medicine, Pomona, CA, Sept. 2013.

"Veterinary Diagnostic Toxicology on the Front Lines of Animal and Human Health", Penn State Huck Institutes of the Life Sciences, University Park, PA, April, 2016.

"Veterinary Toxicology in a One Health Context", University of Illinois, College of Veterinary Medicine Fall Conference, Urbana, IL, October, 2018.

"Plants Poisonous to Livestock", UCD School of Veterinary Medicine, Winter Conference for Veterinarians, Davis, CA, March, 2019.

Teaching

Michigan State University – list available upon request.

University of Pennsylvania – Veterinary School

VANB 607	Pharmacology and Toxicology (2nd Year) I taught the toxicology portion of the course. 19 Lecture Hours 4 Laboratory Hours Arrange guest lecturer for 2 Hours
VPTH 601	Large Animal Pathology (3rd Year) 2 Lecture Hours 14 Laboratory Hours
VCSN 770	Large Animal Medicine (3rd Year) 2 Lecture Hours
VPTH 633	Ecotoxicology for Veterinarians (3rd Year) Course Originator and Moderator: unique course offering students the opportunity to obtain an overview of ecosystem health and the role that environmental contaminants play in wildlife disease. 16 Contact Hours: Lecture, Guest Lecturers, Student Presenations.
VCSP 634	Perspectives on Complementary and Alternative Medicine (3rd Year) Course Originator and Moderator: overview of complementary and alternative medicine from an evidence-based viewpoint. 16 Contact Hours: Lecture, Guest Lecturers, Student Presenations.
VCSN 636	Clinical Pharmacology (3rd Year) 1 Hour Lecture

VCSP 656 Introduction to Wildlife Medicine (1st Year)
1 Hour Lecture

VCSN 882 Food Safety and Quality Assurance (4th Year)
Co-organized the course with Drs. Bensen and Habecker. Unique learning experience for veterinary students emphasizing the role that veterinarians can play in food safety.
1 Hour Lecture
Arrange visits from experts within the PA Department of Agriculture and the FDA's Center for Veterinary Medicine.

VCSP632 Diagnosis of Common Intoxications
Moderator for the course during sabbatical leave of another faculty member – 1999.

Other:

Harcum Student Lecture, 1998, 2001, 2002
Intern Seminar – VHUP, 2000, 2001, 2002, 2003
Resident Seminar – VHUP, 2000; NBC, 2004
Special Species Symposium, 2000, 2001, 2004
Institute of Environmental Studies Lecture, November, 2000
Hoof Camp, NBC Program for Food Animal Students, June, 2002, 2003

University of California at Davis

VMB-414C Veterinary Toxicology (2nd year)
6-8 Lecture Hours
Plant Laboratory

Freshman Undergraduate Seminar CRN 53615 Career Opportunities for Veterinarians
1 Lecture Hour- Research Careers in Veterinary Medicine (academic years 06-07 and 07-08)

VMD-480 Small Animal Toxicology (3rd year)
15 Lecture Hours – Case-based discussion in collaboration with the School's Critical and Emergency Care Service faculty.

PMI-283 Comparative Avian Anatomy and Pathology (3rd year)
1 Lecture Hour – Avian Toxicology (academic years 06-07 and 07-08)

PHR-225 Preventive Avian Medical Practice (3rd year)
1 Lecture Hour – Avian Toxicology (academic year 06-07)

VME-298 Emerging Issues in Ecosystem Health (mix of students
1 Lecture Hour and 1 Discussion Hour – Ecotoxicology (2007 to present)

VET406 Pharmacology/Nutrition/Toxicology Block Lecturer, 1st year veterinary students

VET433C: Small Animal Stream III, Block Co-Leader and Block Lecturer, 3rd year veterinary students

VET435B: Livestock Stream, 3rd year veterinary students

ETX/FST 128: Food Toxicology, Undergraduate/Graduate.

Medical Toxicology Fellowship Program, CAHFS Toxicology Section and UC-Davis Medical Center. On-going comparative toxicology and analytical toxicology training opportunity for MD Toxicology Fellows.

Teaching Aids

Food and Agricultural Careers for Tomorrow, 100 Paths to Success - Toxicologist, career monograph, sponsored by the USDA

Poisonous Plant CAL Website: comprehensive educational website that has been built over 3 years by CAL supported veterinary students. ~ 84,000 "hits" recorded.

CAL Project Grant – 1997
CAL Project Grant – 2000
Toxicology Laboratory Support for CAL Student – 2001, 2002, 2003

Groundbreaking for the NBC Teaching Garden – April 2003, collaborative project with the Chester County Master Gardeners Program.

AAVCT Videodisc Project: compilation of images from veterinary toxicologists from throughout the US.

Professional Educational Presentations

"Small Companion Animal Toxicoses from Ingestion of Rodenticides." Southwestern Michigan VMA, November, 1989.

"Small Animal Toxicology." Midstate Michigan VMA, March, 1990.

"Toxicology for the Small Animal Practitioner." Western Michigan VMA, April, 1990.

"Caged Bird Toxicology." Lansing Caged Bird Club, April, 1991.

"Feed Safety and Quality Assurance: Human and Livestock Health Concerns." Series of three lectures presented to Michigan livestock feed manufacturers, July-August, 1991.

"Veterinary Toxicology Laboratories: Getting the Biggest Bang for Your Buck." Michigan Veterinary Conference, Lansing, MI, 1992.

"Mycotoxins." Michigan Department of Agriculture, Pesticide and Plant Pest Management Division, in-service training conference, January, 1993.

"Mycotoxins: what's up doc?" Michigan Veterinary Conference, Lansing, MI, 1994.

"Equine Toxicology: Something Old and Something New." Michigan Veterinary Conference, Lansing MI, 1994.

"Naturally-Occurring Toxins or Biotoxins." Brandywine VMA, Kennett Square, PA, 1994.

"Veterinary Toxicology Update." Penn-Allegheny VMA, Ebensburg, PA, 1994.

“Biotoxins of Veterinary Importance.” Bucks-Montgomery County VMA and Southern Poconos VMA, October, 1994.

“Mycotoxins and Animal Health.” Pennsylvania Department of Agriculture Spring Plant Industry Training Conference, Carlisle, PA, April, 1995.

“Toxicology in Critical Care Medicine.” Critical Care Section, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, PA, May, 1995.

“Plants Poisonous to Horses.” NBC Lay Lecture Series, November, 1996.

“Plants Poisonous to Sheep.” York County Cooperative Extension Service, Sheep Producers Seminar Series, York, PA, March, 1997.

“Customers, Pets and Vets.” Annual Meeting of the Professional Lawn Care Association of America, Nashville, TN, November, 1998.

“ Managing the Suspect Poisoned Patient: Perspectives of a Humble Veterinary Toxicologist on Decontamination and Antidotal Treatments”, “Illicit drugs: If They’re Toxic Enough to Poison People, They’re Toxic Enough to Poison Pets”, and “Do Herbal and Other Natural Products Pose a Poisoning Risk to Animals? You Betcha They Do.” 6th International Veterinary Emergency and Critical Care Symposium, San Antonio, TX, September, 1998.

“Molds and Toxins”. Grain Management Short Course, Bethlehem, PA, February, 1998.

“Customers, Pets and Vets.” Green Industry Professional Seminar, Annandale, VA, January, 2001.

“Perspectives on Veterinary Complementary and Alternative Medicine.” Canine Symposium, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, PA, January, 2001.

"Overview of Veterinary Complementary and Alternative Medicine." University of Pennsylvania, School of Veterinary Medicine, Board of Overseers Meeting, New York, NY, Spring, 2001.

"Mycotoxins from A to Z." ACVIM Forum, Denver, CO, May, 2001.

"Pets, People and Pesticides." Pennsylvania Area Health Education Center and the Pennsylvania Department of Agriculture, Pesticide Inspector Workshop, Harrisburg, PA, May, 2001.

"Gastrointestinal Decontamination Procedures", "Natural Toxicants", "Illicit Drug Hazards" and "Herbal Hazards". Atlantic Coast Conference, Atlantic City, NJ, September 2001.

"Chemical Agroterrorism." Special joint meeting of the House and Senate Agriculture Committees of the PA House and Senate, Harrisburg, PA, November, 2001.

"Risks Associated with the Use of Natural Products", "OTC and Prescription Drug Intoxications", "Mycotoxins: From A to Z", "Nutritional Metal Analyses: Diagnostics and Interpretation", Chris Lawson Memorial CE Seminar, New Hampshire VMA, Windham, NH, November, 2001.

"Chemical Agroterrorism." Grand Rounds, Department of Clinical Studies – Philadelphia, Philadelphia, PA, December, 2001.

"Chemical Agroterrorism." 102nd Penn Annual Conference, Philadelphia, PA, January, 2002.

"My Pet's Been Poisoned! A Phone Management Primer." Veterinary Technician Program, Western Veterinary Conference, Las Vegas, NV, March, 2002.

"Decontaminating and Detoxifying the Poisoned Patient", "Toxic Household, Garden and Ornamental Plants", Toxicology of Herbal and Dietary Supplements", and "Zootoxins." Western Veterinary Conference, Las Vegas, NV, March, 2002.

"Ricin and Botulinum Toxins", PADLS Foreign Animal Disease Seminar Series, Sept., 2002.

"Evaluation and Management of the Suspect Poisoned Patient", "OTC and Prescription Drug Hazards", "Herbal Hazards", Kansas VMA, Manhattan, KS, June, 2003.

"Toxicologic Investigations", "Chemical Agroterrorism", American Veterinary Medical Association, Denver, CO, July, 2003.

"Poisonous Plants of Veterinary Importance", Penn State Chester County Master Gardeners Program, West Chester, PA, January, 2004.

"Chemical Agroterrorism: Is Anyone Listening?", Penn Annual Conference, Philadelphia, PA, March, 2004.

"To Test or Not To Test – That is the Question. If Yes, Are Screening Tests Useful?", "Did Pookey Eat That Again? Common and Uncommon Intoxications", American Veterinary Medical Association Annual Meeting, Minneapolis, MN, July, 2005.

"Affairs of the Heart: Toxicologic Differentials for Cardiovascular Signs", "To Decontaminate or Not To: What is the Evidence?", "Mind Over Matter: Toxicologic Differentials for CNS Signs", "A One-Two Punch: Toxicologic Differentials for Hepatic and Renal Dysfunction", International Veterinary Emergency and Critical Care Society Annual Meeting, Atlanta, GA, September, 2005.

"Toxicologic Hazards for Camelids", CAL-ILA Annual General Meeting, March, 2006.

"Toxicologic Hazards for Camelids", UC-Davis Alpaca Breeder and Veterinarian Symposium, Davis, CA, January, 2007.

"What Veterinary Technicians Can Do to Help Veterinarians Deal With Animal Poisonings", "Decontaminating Poisoned Pets", "Flora and Fauna: Hazardous Biotoxins for Pets", "Pet Food Recall: Perspectives from the Trenches", "Running in Circles: Poisons Causing CNS Stimulation", "Effective Decontamination Strategies for Poisoned Horses" and "Chemical Terrorism: The Role of the Large Animal Veterinarian", Central Veterinary Conference, Kansas City, MO, August, 2008.

"The Melamine and Cyanuric Acid Story: The Role of CAHFS", UC Provost's Agricultural and Natural Resources Review Committee, Davis, CA, February, 2009.

"Veterinary Toxicology Potpourri", VMTH Resident Seminar, Davis, CA, May, 2009

"The State of Diagnostic Veterinary Toxicology in the U.S.: Are We Prepared?", CDFA Animal Health Branch Statewide Meeting, Sacramento, CA, Sept. 2009.

"A Sustainable Formula for Delivering Quality Diagnostic Toxicology Services", AAVLD/NAHLN Laboratory Director's Meeting, AAVLD Annual Meeting, San Diego, CA, Oct. 2009.

"Poisonous Plants", UC Sierra Foothill Research and Extension Center, Beef and Range Field Day, April, 2011, Browns Valley, CA.

"Veterinary Pharmaceutical Risks to Human Health", Western Toxicology Fellowship Conference, UCD Medical Center, April, 2011, Sacramento, CA.

"Algal Biotoxins: An Emerging Global Health Threat to People and Animals", American Veterinary Medical Association Annual Meeting, July, 2012, San Diego, CA.

"Feline Toxicology", Feline Medicine Club, School of Veterinary Medicine, UC-Davis, Davis, CA, Jan. 2014.

"Poison Proofing Your Home for Pets", Explorit Science Center, Davis, CA, October, 2014.

"Malicious Poisoning of Pets: The Do's and Don'ts of Case Investigation" Student Chapter, Humane Society of the United States, Oregon School of Veterinary Medicine, Oregon State University, Corvallis, OR, November, 2014.

"Toxicology Potpourri: Something Old and Something New", North San Joaquin Veterinary Medical Association, April, 2015.

"Algal Toxins: An Emerging Global Threat to Animals and People", CVC, Washington D.C., April 23-26, 2015.

"Bromethalin and Beyond", CVC, Washington D.C., April 23-26, 2015.

"Chemical Environmental Threats to Wildlife", CVC, Washington D.C., April 23-26, 2015.

"Fat Can Be Good", CVC, Washington D.C., April 23-26, 2015.

"Is There an Antidote in the House?", CVC, Washington D.C., April 23-26, 2015.

"Toxicology Case Vault 1", CVC, Washington D.C., April 23-26, 2015.

"Toxicology Case Vault 2", CVC, Washington D.C., April 23-26, 2015.

"Stump the Toxicologists", CVC, Washington D.C., April 23-26, 2015.

"Zootoxins", CVC, Washington D.C., April 23-26, 2015.

"Toxicology Case Archives: Or Cases that I've Known and Loved", Pet Poison Helpline Webinair, May, 2015.

"Poison Proof Your Home for Your Pets", ACC Senior Services, Sacramento, CA, March, 2015.

"A Day in the Life of a Veterinary Toxicologist", AAPCC Veterinary Symposium, North American Congress of Clinical Toxicology, San Francisco, CA, Oct. 2015.

"Toxicology Section: Investigation, Diagnosis, Protection, Discovery", California Animal Health and Food Safety Laboratory System Advisory Board Meeting, CAHFS, UC-Davis, Oct., 2015.

"Wildlife Toxicology in a Veterinary Diagnostic Laboratory Setting", Humboldt State University, November, 2015.

"California's Diagnostic Laboratory System and Testing to Monitor Products for Assuring Safe Food and Dairy Products", One Health Symposium for Food Safety, Nanjing Agricultural University, Nanjing, China, November 2-4, 2015.

"Environmental Toxicology and Implications for Food Safety", One Health Symposium for Food Safety, Nanjing Agricultural University, Nanjing, China, November 2-4, 2015.

"Environmental Toxicology and Implications for Food Safety", International Symposium on Zoonosis and Food Safety", College of Veterinary Medicine, Yangzhou University, Jiangsu, China, November 5, 2015.

"Environmental Toxicology and Implications for Food Safety and Security", One Health for Food Safety Conference for Animal and Veterinary Scientists, School of Veterinary Medicine, UC-Davis, Dec., 2015.

"Water, Water Everywhere, But Not a Drop to Drink: Water Quality for Beef Cattle", "What is Blue and Green and a Threat to Livestock", "That Plant Looks Yummy", and Doc, I Think that My Cattle Have Been Poisoned!", Western Veterinary Conference, Las Vegas, NV, March, 2016.

"Pivotal Roles of Diagnostic Toxicology in Wildlife, Domestic Animal, and Human Health", "Veterinary Diagnostic Toxicology: On the Front Lines of Animal and Human Health", Penn State University, April, 2016.

"Small Animal Diagnostic Toxicology", Peninsula Veterinary Medical Association Meeting, San Mateo, CA, May, 2016.

"Veterinary Toxicology", University of California at Berkeley, Pre-Vet Club, January, 2017.

"Metals That Pollute Our Environment and Adversely Affect Human and Animal Health", Integrating Veterinary Medicine, Animal Science, and Agricultural Engineering Through One Health, Nanjing University and University of California, WIFSS, August, 2018.

"Ecotoxicology", Fall Conference for Veterinarians, Illinois College of Veterinary Medicine, Urbana, IL, Oct. 2018.

"Toxicology Potpourri", Kokopelli Continuing Education Series, DVM Track and Tech Track, Roseville, CA, October, 2019. (N=20)

"CAHFS' Toxicology Section, So what does a veterinary diagnostic laboratory do anyway (i.e., why do CA taxpayers give us money)?", UCD Forensic Science Graduate Group, November 1, 2019. (N=15)

Other

Successes and Failures Associated with the 2007 Pet Food Recall: Expert Panel Update, 144th Annual Meeting of the American Veterinary Medical Association Meeting, Washington D.C., July, 2007.

CAHFS and melamine. Pacific and Southwest Regional FERN Meeting, Oakland, CA, August, 2007.

The Pet Food Recall Story. 20th Annual Fall Symposium on Recent Advances in Clinical Medicine, UC-Davis School of Veterinary Medicine, Davis, CA, September, 2007.

Radiation. Review for the American Board of Veterinary Toxicology Certification Examination, Davis, CA, June 2012.

Harper Career Days: Veterinary Medicine, 2014, 2015.

Explorit Science Center, Davis, CA March 3, 2016, Blue-Green Algae: The Good, The Bad and the Ugly.

Food Animal and Reproduction Club Symposium, Poisonous Plant Wet Lab, February 9, 2019.

Outside Review

2012, 2015: Center for Veterinary Medicine's Minor Use Minor Species Development of Drugs, Research Grant Program.

Publications

Peer Reviewed

1. Lorenzana, R.M., Beasley, V.R., Buck, W.B., Ghent, A.W., Lundeen, G.R., and **Poppenga, R.H.** (1985): Experimental T-2 toxicosis in swine. I. Changes in cardiac output, aortic mean pressure, catecholamines, 6-keto $PGF_{1\alpha}$, thromboxane B_2, and acid-base parameters. Fundamental and Applied Toxicology, 5: 879-892.

2. Lundeen, G.R., **Poppenga, R.H.**, Beasley, V.R., Buck, W.B., and Lambert, R.J. (1986): Systemic distribution of blood flow during acute T-2 toxin induced shock in swine. Fundamental and Applied Toxicology, 7: 309-323.

3. **Poppenga, R.H.**, Beasley, V.R., and Buck, W.B. (1986): Assessment of potential therapies for acute T-2 toxicosis in the rat. Toxicon, 25(5): 537-546.

4. **Poppenga, R.H.**, Lundeen, G.R., Beasley, V.R., and Buck, W.B. (1986): Assessment of a general therapeutic protocol for the treatment of acute T-2 toxicosis in swine. Veterinary and Human Toxicology, 29(3): 237-239.

5. Beasley, V.R., Lundeen, G.R., **Poppenga, R.H.**, and Buck, W.B. (1987): Distribution of blood flow to the gastrointestinal tract of swine during T-2 toxin-induced shock. Fundamental and Applied Toxicology, 9: 588-594.

6. McGuire, J.T., Dierenfeld, E.S., **Poppenga, R.H.**, and Braselton, W.B. (1987): Plasma alpha-tocopherol, retinol, cholesterol, and mineral concentrations in captive gorillas. Journal of Medical Primatology, 18: 155-161.

7. **Poppenga, R.H.** and Braselton, W.E. (1990): Effective use of analytical laboratories for the diagnosis of veterinary toxicologic problems in small animal practice. Veterinary Clinics of North America: Small Animal Practice, 20(2): 293-306.

8. **Poppenga, R.H.**, Trapp, A.L., Braselton, W.E., Louden, C.G., Gumbs, J.M., and Dalley, J.B. (1990): Hexachlorophene toxicosis in a litter of Doberman Pinschers. Journal of Veterinary Diagnostic Investigation, 2: 129-131.

9. Bonna, R.J., Aulerich, R.J., Bursian, S.J., **Poppenga, R.H.**, Braselton, W.E., and Watson, G.L. (1991): Efficacy of hydrated sodium calcium aluminosilicate and activated charcoal in reducing the toxicity of dietary aflatoxin to mink. Archives of Environmental Contamination and Toxicology, 20: 441-447.

10. Aulerich, R.J., Bursian, S.J., **Poppenga, R.H.**, Mullaney, T.P., and Braselton, W.E. (1991): Toleration of high concentrations of dietary zinc by mink. Journal of Veterinary Diagnostic Investigation, 3: 232-237.

11. Lundeen, G.R., **Poppenga, R.H.**, Beasley, V.R., Manuel, R.K., Buck, W.B., and Tranquilli, W.J. (1991): Regional brain blood flow in swine following T-2 toxin administration. Veterinary and Human Toxicology, 33(6): 567-570.

12. Lavelle. J.M., **Poppenga. R.H.**, Thacker. B.J., Giesy. J.L., Weis. C., Othoudt. R., and Vandervoort. C. (1991): Bioavailability of lead in mining wastes: an oral intubation study in young swine. Chemical Speciation and Bioavailability, 3(3-4): 105-111.

13. Sudekum, M., **Poppenga, R.H.**, Raju, N., and Braselton, W.E. (1992): Pennyroyal oil toxicosis in a dog. Journal of the American Veterinary Medical Association, 200(6): 817-818.

14. Fischer, L.J., Thulin, A.J., Zabik, M.E., Booren, A.M., **Poppenga, R.H.,** and Chapman, K.J. (1992): Sulfamethazine and its metabolites in pork: effects of cooking on gastrointestinal absorption of residues. Journal of Agricultural and Food Chemistry, 40: 1677-1682.

15. Braselton, W.E., Neiger, R.D., and **Poppenga, R.H.** (1992): Confirmation of indandione rodenticide toxicosis by mass spectrometry/mass spectrometry. Journal of Veterinary Diagnostic Investigation, 4: 441-446.

16. O'Brien, D.J., Kaneene, J.B., and **Poppenga, R.H.** (1993): The use of mammals as sentinels for human exposure to toxic contaminants in the environment. Environmental Health Perspectives, 99: 351-368.

17. Fitzgerald, S.D. and **Poppenga, R.H.** (1993): Toxicosis due to microcystin hepatoxins in three Holstein heifers. Journal of Veterinary Diagnostic Investigation, 5: 651-653.

18. Pearson, E.G., Hedstrom, O.R., and **Poppenga, R.H.** (1994): Hepatic cirrhosis and hemochromatosis in three horses. Journal of the American Veterinary Medical Association, 204(7): 1053-1056.

19. Fikes, J.D., Render, J.A., Reed, W.M., Bursian, S., **Poppenga, R.H.**, and Sleight, S.D. (1994): Insensitivity of the chicken embryo to the ototoxicity of aminoglycoside antibiotics and a loop diuretic. Toxicologic Pathology, 20(1): 10-14.

20. Fikes, J.D., Render, J.A., Reed, W.M., Bursian, S., **Poppenga, R.H.**, and Sleight, S.D. (1994): Distribution of gentamicin to the cochlea of the chicken embryo. Toxicologic Pathology, 20(): 15-22.

21. Yamini, B., **Poppenga, R.H.**, Braselton, W.E., and Judge, L.J. (1995): Dicoumarol (moldy sweet clover) toxicosis in a group of Holstein heifers. Journal of Veterinary Diagnostic Investigation, 7: 420-422.

22. O'Brien, D.J., **Poppenga, R.H.**, and Ramm, C.W. (1995): An exploratory analysis of liver element relationships and causes of death in a case series of common loons (*Gavia immer*). Preventative Veterinary Medicine, 25: 37-49.

23. Allen, G.T., Veatch, J.K., Stroud, R.K., Vendel, C.G., **Poppenga, R.H.**, Thompson, L., Shafer, J., and Braselton, W.E. (1996): Winter of poisoning of coyotes and raptors furadan laced carcass baits. Journal of Wildlife Diseases, 32(2): 385-389.

24. Cudia, S.P., **Poppenga, R.H.**, and Birdsall, W.J. (1998): Pemoline toxicosis in a dog. Journal of the American Veterinary Medical Association, 212(1): 74-76.

25. Schultze, A.E., **Poppenga, R.H.**, and Johnson, D.K. (1998): Alterations in serum and tissue iron profiles associated with mutations in the *fitness1*^{4226SB} locus of mice. Comparative Haematology International, 8: 72-76.

26. Hollmen, T., Franson, J.C., **Poppenga, R.H.**, Hario, M., and Kilpi, M. (1998): Lead poisoning and trace elements in common eiders *Somateria mollissima* from Finland. Wildlife Biology, 4(4): 193-203.

27. Sepulveda, M.S., **Poppenga, R.H**., Arrecis, J.J., and Quinn, L.B. (1998): Concentrations of mercury and selenium in tissues of double-crested cormorants (*Phalacrocorax auritus*) from southern Florida. Colonial Waterbirds, 21(1): 35-42.

28. Beal, M.W., **Poppenga, R.H.**, Birdsall, W.J., and Hughes, D. (1999): Ventilatory failure due to moxidectin intoxication in a dog. Journal of the American Veterinary Medical Association, 215(12): 1813-1817.

29. Agnew, D.W., Barbiers, R.B., **Poppenga, R.H.**, and Watson, G.L. (1999): Zinc toxicosis in a captive striped hyena (*Hyaena hyaena*). Journal of Zoo and Wildlife Medicine, 30(3): 431-434.

30. **Poppenga, R.H.** (2000): Rodenticide toxicosis in dogs and cats. Standards of Care: Emergency and Critical Care Medicine, 2:5-10.

31. Franson, J.C., Hollmen, T., **Poppenga, R.H.**, Hario, M., and Kilpi, M. (2000): Metals and trace elements in tissues of Common Eiders (*Somateria mollissima*) from the Finnish archipelago. Ornis Fennica 77: 57-63.

32. Hoffman, R.J., Hoffman, R.S., Freyberg, C., **Poppenga, R.H.**, and Nelson, L.S. (2001): Clenbuterol ingestion causing prolonged tachycardia, hypokalemia and hypophosphatemia with confirmation by quantitative levels. Journal of Toxicology – Clinical Toxicology 39(4): 339-344.

33. Franson, J.C., Hollmen, T., **Poppenga, R.H.**, Hario, M., Kilpi, M., and Smith, M.R. (2000): Selected trace elements and organochlorines: some findings in blood and eggs of nesting common eiders (Somateria mollissima) from Finland. Environmental Toxicology and Chemistry, 19(5): 1340-1347.

34. Lewis, L.A., **Poppenga, R.H.**, Davidson, W.R., Fischer, J.R., and Morgan, K.A. (2001). Lead toxicosis and trace element levels in wild birds and mammals at a firearms training facility. Archives of Environmental Contamination and Toxicology 41: 208-214.

35. Schoeb, T.R., Heaton-Jones, T.G., Clemmons, R.M., Carbonneau, D.A., Woodward, A.R., Shelton, D., and **Poppenga, R.H.** (2002): Clinical and necropsy findings associated with increased mortality among alligators of Lake Griffin, Florida. Journal of Wildlife Diseases 38(2): 320-337.

36. **Poppenga, R.H.** and Spoo, W. (2002): Internet resources for veterinary toxicologists. Toxicology 173: 179-189.

37. Snook, C.S., Baird A.N., **Poppenga, R.H.**, Rudik, I., and Sweeney, R.W. (2002): Plasma concentrations of trimethoprim and sulphamethoxazole in llamas after orogastric administration. Journal of Veterinary Pharmacology and Therapeutics 25(5): 383-386.

38. Evers, D.C., Taylor, K.M., Major, A., Taylor, R.J., **Poppenga, R.H.**, and Scheuhammer, A.M. (2003): Common loon eggs as indicators of methylmercury availability in North America. Ecotoxicology 12: 69-81.

39. Rudik, I., Cummings, M.R., and **Poppenga, R.H.** (2003): Isolation and multi-residue detection of macrolide endectocides present in animal matrices. Journal of Veterinary Diagnostic Investigation 14: 295-302.

40. Rudik-Miksa, I. and **Poppenga, R.H.** (2003): Direct and rapid determination of baclofen (Lioresal®) and carisoprodol (Soma®) in bovine serum by liquid chromatography-mass spectrometry. Journal of Analytical Toxicology, 27: 275-283.

41. Sidor, I.F., Pokras, M.A., Major, A.R., **Poppenga, R.H.**, Taylor, K.M., and Miconi, R.M. (2003): Mortality of common loons in New England, 1987 to 2000. Journal of Wildlife Diseases, 39(2): 306-310.

42. Rudik-Miksa, I., Buckley, C.L., and **Poppenga, R.H.** (2004): Detection of nonesterified (free) fatty acids in bovine serum: comparative evaluation of two methods. Journal of Veterinary Diagnostic Investigation, 16: 139-144.

43. Pelligrini-Masini, A., **Poppenga, R.H**., and Sweeney, R.W. (2004): Disposition of a flunixin meglumine injectable preparation administered orally to healthy horses. Journal of Veterinary Pharmacology and Therapeutics, 27: 183-186, 2004.

44. Orsini, J.A., Moate, P.J., Boston, R.C., Engiles, J., Benson, C.E., **Poppenga, R.**, and Norman, T. (2004): Cefotaxime kinetics in plasma and synovial fluid following intravenous administration in horses. Journal of Veterinary Pharmacology and Therapeutics 27: 293-298, 2004.

45. **Poppenga, R.H.**, Zeigler, A., Habecker, P., Walter, M., and Miller P. (2005): Zinc phosphide toxicosis in wild turkeys (*Meleagris gallopavo*). Journal of Wildlife Diseases, 41(1): 218-223.

46. Evers, D.C., Burgess, N.M., Champoux, L., Hoskins, B., Major, A., Goodale, W., Taylor, R.J., **Poppenga, R.** and Daigle, T. (2005): Patterns and interpretation of mercury exposure in freshwater avian communities in northeastern North America. Ecotoxicology, 14(1-2): 193-221.

47. Rudik-Miksa, I., Buckley, C.L., Carpenter, N., and **Poppenga, R.H.** (2005): Comparison of selenium detection in liver samples by atomic absorption spectroscopy and inductively coupled plasma – mass spectrometry. Journal of Veterinary Diagnostic Investigation, 17(4): 331-340.

48. Troxel, M.T. and **Poppenga, R.H.** (2005): Kentucky coffee tree intoxication in a dog with cerebellovestibular signs, bradycardia, hypotension and hypoglycemia. Journal of Veterinary Internal Medicine, 19(4): 599-601.

49. Rosenthal, K.L., Johnston, M.S., Shofer, F.S., and **Poppenga, R.H.** (2005): Psittacine plasma concentrations of elements: daily fluctuations and clinical implications. Journal of Veterinary Diagnostic Investigation, 17(3): 239-244.

50. Miksa, I.R., Cummings, M.R., and **Poppenga, R.H.** (2005): Multi-residue determination of anti-inflammatory analgesics in sera by liquid chromatography-mass spectrometry. Journal of Analytical Toxicology, 29(2): 95-104.

51. Orsini, J.A., Moate, P.J., Boston, R.C., Norman, T., Engiles, J., Benson, C.E., and **Poppenga, R.H.** (2005): Pharmacokinetics of imipenem-cilastatin following intravenous administration in healthy adult horses. Journal of Veterinary Pharmacology and Therapeutics, 28(4): 355-361.

52. Rudik-Miksa, I., Cummings, M.R., and **Poppenga, R.H.** (2005): Determination of acepromazine, ketamine, medetomidine and xylazine in serum: multi-residue screening by liquid chromatography-mass spectrometry. Journal of Analytical Toxicology, 29(6): 544-552.

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    - Blue-green algae toxicosis
    - Iron toxicosis
    - Malicious poisoning
    - Mercury toxicosis
    - Nitrates/nitrites toxicosis
    - Pentachlorophenol (PCP) toxicosis
    - *Robinia pseduoacacia* toxicosis
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    - Blue-green algae toxicosis
    - Iron toxicosis
    - Malicious poisoning
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    - *Solanium* spp. toxicosis
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81. Puschner, B., **Poppenga, R**., Pesavento, P., Tor, E., Lowenstine, L. and Filigenzi, M.: Assessment of melamine and cyanuric acid toxicity in cats. 50th Annual Meeting of the American Association of Veterinary Laboratory Diagnosticians, Reno, NV, October, 2007.

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84. Shivaprasad, H.L., Puschner, B. and **Poppenga, R.H.**: Vitamin A deficiency in psittacines. 27th Annual Meeting of the Association of Avian Veterinarians, Providence, R.I., August, 2007.

85. Van Saun, R.H. and **Poppenga, R.H.**: Comparisons between bovine maternal and fetal hepatic mineral content. 13th International Conference on Production Diseases in Farm Animals, Leipzig, Germany, July/August, 2007.

86. Van Saun, R.H. and **Poppenga, R.H.**: Factors influencing bovine maternal and fetal hepatic mineral concentrations. 13th International Conference on Production Diseases in Farm Animals, Leipzig, Germany, July/August, 2007.

87. Van Saun, R.H. and **Poppenga, R.H.**: Breed effects on bovine fetal and maternal hepatic mineral concentrations. 13th International Conference on Production Diseases in Farm Animals, Leipzig, Germany, July/August, 2007.

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90. Filigenzi, M., Puschner, B., Tiwary, A. and **Poppenga, R.**: Diagnostic analysis for metal phosphide compounds in stomach content by SPME-GC/MS. AOAC International Midwest Section, Bozeman, MT, July, 2008.

91. Gonzales, G., Filigenzi, M., Puschner, B. and **Poppenga, R.**: Dectection of ricin in animal tissues using a monoclonal antibody-based enzyme immunoassay. AOAC International Midwest Section, Bozeman, MT, July, 2008.

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93. Tor, E.R., Puschner, B. and **Poppenga, R.H.**: Rapid screening of samples for Avitrol by LC/MS/MS. AAVLD Annual Meeting, Greensboro, NC, Oct. 2008.

94. Pokras, M.A., Kneeland, M.R., Major, A., Miconi, R. and **Poppenga R.H.**: Lead objects ingested by common loons in New England. Ingestion of lead from spent ammunition: implications for wildlife and humans. Conference Proceedings, Boise, ID, May 2008.

95. Stump S., Puschner, B. and **Poppenga, R.H.**: Experiences with T025. Food Emergency Response Network Technical Meeting, New Haven, CT, Aug. 2009.

96. Filigenzi, M., **Poppenga, R.H.**, Puschner, B.: More melamine adventures. Food Emergency Response Network Technical Meeting, New Haven, CT, Aug. 2009.

97. Holser, I., Melton, L., Poppenga, R.H.: Software for improved ICP-MS Data Handling. Food Emergency Response Network Technical Meeting, New Haven, CT, Aug. 2009.

98. Ruder, M.G., Bryan, J.A., Keel, K., Fischer, J.R., **Poppenga, R.H.**, Bain, M. and Pitman, J.: Intoxication of non-target wildlife with rodenticides in northwestern Kansas. Wildlife Disease Association Annual Meeting, Blaine, WA, Aug. 2009.

99. Schildt, J., Jutkowitz, L.A., Beal, M.W., **Poppenga, R.H.**, Koenigshof, A. and Hauptman, J.G.: Effect of activated charcoal alone versus emesis and activated charcoal on carprofen absorption following experimental overdose in dogs. International Veterinary Emergency and Critical Care Annual Meeting, Chicago, Sept. 2009.

100. **Poppenga, R.H**., Puschner, B., Tiwary, A., Mukai, M., Chhetri, B. and Filigenzi, M.: Amanitin intoxication in dogs: 2005-2009. AAVLD, Oct. 2009.

101. Holser, I., Melton, L., Aston, L. and **Poppenga, R**.: Overview of lead isotope ratios in lead sources and exposed raptors. Annual Meeting of the American Association of Veterinary Laboratory Diagnosticians, San Diego, Oct. 2009.

102. Mukai, M., Russell, N., Boyd, R., Doescher, B. and **Poppenga, R.**: Unusual cases of *Nerium oleander* toxicosis: a dog and a sea lion, Annual Meeting of the American Association of Veterinary Laboratory Diagnosticians, San Diego, Oct. 2009.

103. Tor, E., Puschner, B., Filigenzi, M., Aston, L. and **Poppenga, R.**: Detection of tetrodotoxin in GI and kidney samples by LC-MS/MS. Annual Meeting of the American Association of Veterinary Laboratory Diagnosticians, San Diego, Oct. 2009.

104. Filigenzi, M., Tor, E., **Poppenga, R**. and Puschner, B.: Food analysis in the veterinary toxicology laboratory. 36th Federation of Analytical Chemistry and Spectroscopy Societies Meeting, Louisville, Oct. 2009.

105. Reis, J.L., **Poppenga, R.H**. and Howerth, E.W.: Simultaneous acute Amanita sp. toxicosis in a bitch and its puppy. American College of Veterinary Pathology Meeting, 2009.

106. Filigenzi, M., Aston, L. and **Poppenga, R.**: Analysis of anticoagulant rodenticides by HPLC and LC-MS/MS. FERN National Training Conference, Minneapolis, MN, June, 2010.

107. Koenigshof, A.M., Beal, M.W., **Poppenga, R.H.** and Jutkowitz, L.A.: Effect of sorbitol and single and multi-dose activated charcoal administration on carprofen absorption following experimental overdose in dogs. Annual Meeting of the Veterinary Emergency and Critical Care Society Meeting, San Antonio, TX, Sept., 2010.

108. **Poppenga, R.H.**, Woods, L., Blanchard, P., Mays, T., Boothe, M., Garland, T., Childers, B. and Lyon, M.: Acute avocado (Persea Americana) intoxication in goats: two cases. 53rd Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Minneapolis, MN, Nov. 2010.

109. Filigenzi, M., Tor, E., Aston, L. and **Poppenga, R.H.**: When every milli-mass unit counts: the application of high resolution mass spectrometry in a veterinary diagnostic laboratory. 53rd Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Minneapolis, MN, Nov. 2010.

110. Filigenzi, M. and **Poppenga, R.**: Rapid screening for toxicants using DART and UHPLC-high resolution mass spectrometry. 54th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Buffalo, NY, Oct. 2011.

111. **Poppenga, R.**, Filigenzi, M., Riley, S. et al.: The detection and interpretation of liver anticoagulant rodenticide concentrations in diverse avian and mammalian wildlife species. 54th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Buffalo, NY, Oct. 2011.

112. Mukai, M., Stump, S., Smith, J., Uzal, F., **Poppenga, R.**, Woods, L. and Puschner, B.: Detection of toluene-2,4-diisocyanate in nesting material associated with mortality in pigeon chicks. 54th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Buffalo, NY, Oct. 2011.

113. Tor, E., Aston, L. and **Poppenga, R.**: Screening and confirmation of veterinary drugs in milk and milk-products by LC-MS/MS. 54th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Buffalo, NY, Oct. 2011.

114. **Poppenga, R.H.**, Alarcio, G. and Tor, E.: Screening and confirmation of illicit drugs in biological samples by LC-MS/MS. 55th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Greensboro, NC, Oct. 2012.

115. Alarcio, G., Tahara, J., Tor, E., Aston, L. and **Poppenga, R.H.**: Challenges with vitamin A quantification in feeds and biological samples. 55th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Greensboro, NC, Oct. 2012.

116. Snider, D., Rumbeiha, W.K., Filstrup, T., Downing, J.A., **Poppenga, R.H.**, Shlosberg, A. and Ensley, S.M.: Investigation into Veterinary Diagnostic Approaches for Cyanobacterial Intoxication. 56th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, San Diego, CA, Oct., 2013.

117. Rumbeiha, W.K., Imerman, P.M., Snider, D., **Poppenga, R.H.**, Ensley, S.M. and Bildfell, R.: An Atypical Case of Anatoxin-A Intoxication in a Dog and Quantitative Analysis of Biomarkers of Exposure. 56th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, San Diego, CA, Oct., 2013.

118. **Poppenga, R.H.**, Stanley, S., Arthur, R., Tor, E., Alarcio, G., Aston, L., Davidson, M. and Castro G.: Accidental Contamination of Equine Feed with Zilpaterol Resulting in Widespread Detection of the Drug in Urine Samples from Performance Horses. 56th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, San Diego, CA, Oct., 2013.

119. Ostrowski, S.R., **Poppenga, R.H.**, Uzal, F. and Kelly, L.H.: Equine and Bovine Fluorosis attributable to high-fluoride well water in Southern California. 56th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, San Diego, CA, Oct., 2013.

120. Hill, A., Aston, L., Tor, E.R., **Poppenga, R.H.** and Kinde, H.: Evaluation of a Commercially-Available ELISA for Detection of $\geq$ 500 pt Aflatoxin M1 in Milk. 56th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, San Diego, CA, Oct., 2013.

121. Rimoldi, G., Giannitti, F., Bautista, A.C., Tawde, S., Anderson, M.L. and **Poppenga, R.H.**: Phosphide Poisoning in 4 Equids in California. 56th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, San Diego, CA, Oct., 2013.

122. Thompson, C., Gabriel, M., Purcell, K., Higley, J.M., Wengert, G., Sweitzer, R., Barrett, R., **Poppenga, R.**, Woods, L., and Krogen, S.: Impacts of illegal marijuana grows on

fisher research in the Sierra Nevadas. Annual Meeting of the Wildlife Society Western Section, Reno, NV, Jan., 2014.

123. Higley, M., Gabriel, M., Wengert, G., Woods, L., **Poppenga, R.**, Thompson, C. and Krogen, S.: It's just a plant: fishers, marijuana and the broader ecological implications. Annual Meeting of the Wildlife Society Western Section, Reno, NV, Jan., 2014.

124. Mikoni, N., Tell, L. and **Poppenga, R.H.**: Biomarkers of the avian world: measuring baseline heavy metal concentrations in feathers and tissues from Anna's hummingbirds (Calypte anna). 10th Annual Stars in Science Poster Presentations, School of Veterinary Medicine, University of California, Aug., 2015.

125. Gabriel, M., **Poppenga, R.H.**, Woods, L.W., Higley, M., Wengert, G. and Filigenzi, M.: Wildlife Poisonings Associated with Illegal Marijuana Grow Sites on Public and Tribal Lands in California. 58th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Providence, RI, Oct., 2015.

126. Talcott, P., Filigenzi, M. and **Poppenga, R.H.**: Accidental, or intentional, xylitol poisoning in canines as a result of ingesting xylitol-laced baits used to control predators (e.g., wolves). 58th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Providence, RI, Oct., 2015.

127. Filigenzi, M., Tell, L. and **Poppenga, R.H.**: An analytical method for the analysis of eight neonicotinoid insecticides in hummingbird remains. 58th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Providence, RI, Oct., 2015.

128. Carvallo, F.R., **Poppenga, R.H.**, Kinde, H., Nyaoke, C.A., Diab, S., Moeller, R.B., Arthur, R.M. and Uzal, F.A.: Finding traces of rodenticide anticoagulant in the liver of race horses. 58th Annual Conference of the American Association of Veterinary Laboratory Diagnosticians, Providence, RI, Oct., 2015.

129. Colby, D.K., Albertson, T.E., Chenoweth, J.A., **Poppenga, R.H.**, Owen, K.P., Ford, J.B. and Sutter, M.E.: 1,4 Butanediol withdrawal and pharmacologic management: a case series, Annual Meeting, North American Congress of Clinical Toxicology, San Francisco, CA, Oct., 2015, 53(7):675.

130. Arthur, R., Carvallo, F., **Poppenga, R**., Kinde, H., Diab, S., Nyaoke, A., Hill, A., Salmon, J., and Uzal, F.: Idiopathic hemorrhage associated with anticoagulant rodenticide exposure in exercising horses. AAEP, Las Vegas, Nevada, 2015

131. Rogers, K.H., McMillin,S., Mete, A., and **Poppenga, R.H.**: Disease and contaminant surveillance in California raptors: a preliminary analysis. Raptor Research Foundation Annual Conference, Oct 4-8, 57, 2015.

132. Hahn, J.L., Sofield, R.M., Ylitalo, G.M., **Poppenga, R.H.**, West, J.E., Hollenhorst, S.J., Van Alstyne, K.L., and Gaydos, J.K.: Seaweed or contaminated product: Cross-Border Pilot Study on Salish Seaweed Contaminants. Salish Sea Ecosystem Conference, Vancouver, BC, April, 2016.

133. Godwin, B.L., Tell, L.A., **Poppenga, R**., and Ernest, H.B.: Heavy metal accumulation in western hummingbirds: population health and role as sentinel species. Wildlife Society, Raleigh, NC, October, 2016.

134. Schild, C.O., Giannitti, F., Medeiros, R., Caffarena, R.D., **Poppenga, R.H**., and Riet-Correa, F.: Acute lead arsenate poisoning in beef cattle in Uruguay. 59th Annual Meeting, AAVLD, Greensboro, NC, October, 2016.

135. Filigenzi, M., **Poppenga, B**., Rhea, M., and Uzal, F.: Analysis of vitamin B12 in equine liver using immunoaffinity clean-up and LC-MS/MS. 59th Annual Meeting, AAVLD, Greensboro, NC, October, 2016.

136. Filigenzi, M., **Poppenga, R.H.**: Use of high resolution accurate mass LC-MS for the identification of an uncommon cardiotoxic glycoside in liver tissue. Submitted for 60th Annual Meeting, AAVLD, San Diego, CA, November, 2017.

137. Filigenzi, M., Aston, L., Noonan, R., and **Poppenga R.**: A real doggie downer: pentobarbital in pet food. FERN Annual Technical Meeting, Kansas City, July, 2018.

138. Romano, M.C., Francis, K.A., Janes, J.G., Adams, A.A., **Poppenga, R.H.**, Filigenzi, M., and Gaskill, C.: Determining approximate minimum toxic doses of diphacinone in horses and corresponding serum, blood, and liver diphacinone concentrations. Annual Meeting, AAVLD, Providence, R.I., November, 2019.

139. Alarcio, G., Tor, E.R., Aston, L. and **Poppenga, R.H.**: Quantitation of ionophores in animal feed samples, Annual Meeting, AAVLD, Providence, R.I., November, 2019.

140. **Poppenga, R.H.**, Filigenzi, M., and Noonan, R.: Liver and muscle tissue pentobarbital concentrations following euthanasia, Annual Meeting, AAVLD, Providence, R.I., November. 2019.

141. Alarcio, G., Tor, E.R., Aston, L.S., and **Poppenga, R.H.**: Illicit drugs of abuse screen in biological samples by LC-MS. Annual Meeting, AAVLD, Providence, R.I., November, 2019.

142. Thiriveedhi, V., Filigenzi, M., and **Poppenga, R.H.**: Development and validation of a method for quantification of vitamin D in pet food. Annual Meeting, AAVLD, Providence, R.I., November 2019.

Case Presentations

1. Gabriel, M., Higley, J.M., Wengert, G., Woods, L., Filigenzi, M. and **Poppenga R.**: Pacific Fishers and Illegal Marijuana Grow Sites: A Lethal Mix. American Association of Veterinary and Comparative Toxicology Annual Meeting, San Diego, CA, Oct. 2013.

2. **Poppenga, R.H.**, Filigenzi, M., Kaae, J., Hill, A., Bever, C.: Amanitin Update. American Association of Veterinary and Comparative Toxicology Annual Meeting, San Diego, CA, November, 2019.

3. Filigenzi, M. and **Poppenga, R.H.**: A case of malicious poisoning in a dog. American Association of Veterinary and Comparative Toxicology Annual Meeting, San Diego, CA, November, 2019.

Reports

1. Dellinger, J.A., **Poppenga, R.H.**, and Zaber, D.J. (1986): Protocols for testing drinking water contaminated by threat agents. A final report to the Environmental Sciences Division of Lawrence Livermore Laboratory.

2. Lorenzana, R.M., Duncan, B., Ketterer, M., Lowry, J., Simon, J., Dawson, M., and **Poppenga, R.** (1996): Bioavailability of arsenic and lead in environmental substrates. USEPA Report 910/R-96-002.

3. **Poppenga, R.H.**, Birdsall, W.J., and Buckley, C. (2000): Terbinafine pharmacokinetics following oral administration to dogs, cats and horses. Novartis Pharmaceuticals.

4. Hanson, E.C., Wack, R.F., **Poppenga, R.**, Strohm, K., Johnson, C., Bunn, D. and Scherer, R. (2011): Comparative pathology, health, and contaminant exposure within San Joaquin Valley and Sacramento Valley giant garter snake (*Thamnophis gigas*) populations. CA Central Valley Project Conservation Program.

5. **R. Poppenga**, N. Ashbolt, A. Mikolon, B. Pecson, C. Rock, and D. Smith (2018): *Independent Advisory Panel Final Report: Using Disinfected Tertiary Recycled Water for Non-Dairy Livestock Watering: A Human and Animal Health Evaluation for the State of California*. Prepared for the California State Water Resources Control Board by the National Water Research Institute, Fountain Valley, California.

6. R. Poppenga and A. Sobhakumari (2017): Proposed analytical reporting limits for glyceraldehyde, dihydroxyacetone, tartronic acid, glycolic acid, glyoxylic acid, oxalic acid and diglycolic acid. Food and Drug Administration, Veterinary Laboratory Investigation and Response Network.

Non-Refereed Articles and Other Publications

1. **Poppenga, R.H.**: Serum mineral determinations. Animal Health Diagnostic Laboratory Newsletter, 4(4):2.

2. Baker, J.C. and **Poppenga, R.H.**: Lead poisoning in cattle. Animal Health Diagnostic Laboratory Newsletter, 6(3):1-3.

3. **Poppenga, R.H.**: Is ethoxyquin in pet foods hazardous to animal health? Animal Health Diagnostic Laboratory Newsletter, 6(4):1-3.

4. **Poppenga, R.H.** and Brown, C.: Toxic hazards to horses. Educational pamphlet, sponsored by the Michigan Department of Agriculture, MSU College of Veterinary Medicine, and the Michigan Farm Bureau, 1990.

5. Rook, J.S. and **Poppenga, R.H.**: Sheep producers with moldy feed: is there a problem? Vet Watch, 12(5), MSU Veterinary Medicine Extension, 1993. Reprinted as "Forages and grains in the moldy midwest: potential for problems?", The Shephard, 38(5): 18-20.

6. Rook, J.S. and **Poppenga, R.H.**: Horses and moldy feed: how concerned should you be? Vet Watch, 12(5), MSU Veterinary Medicine Extension, 1993.

7. **Poppenga, R.H.**: Food and agricultural careers for tomorrow: toxicology. Poster entitled "Living Science", supported by the USDA Higher Education Program and Purdue University, School of Agriculture, 1993.

8. **Poppenga, R.H.**: Hoary alyssum: potential hazard to horses. Michigan Harness Horseman, 25(9): 22-23, 1993.

9. Herdt, T.M., Braselton, W.B., Jr., **Poppenga, R.H.**, and Wikse, S.: Bovine copper status by liver needle biopsy. Animal Health Diagnostic Newsletter, 10(2):2-3.

10. **Poppenga, R.H.**: Fumonisin mycotoxins: threat to Michigan horses and food-producing animals? Animal Health Diagnostic Laboratory Newsletter, 10(4):2-3.

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EXHIBIT B

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Deposition of Digvijay Gurung – 9/11/2018 Volume 1, pages 1-178, exhibits 1-25

Deposition of Digvijay Gurung – 9/11/2018 Volume 1, pages 1-56, exhibits 26-32

Deposition of Daniel Zeiger – 9/19/2018

Deposition of Greg Kean – 9/19/2018 and associated exhibits

Declaration of Gregory Kean – 9/9/2020

Dr. Gary Pusillo Expert Report: Examination of WellPet LLC for Safety, Nutrition, and Health, June 29, 2020, and referenced documents

Sean Callen Expert Report and referenced documents

Callan Production Documents

Ellipse Analytics: Analytical Sample Submissions, Analytical Request Forms, BPA QC documents

Pusillo Production Documents

ICPMS QC data

ISUVDL data

Chemical Solutions trace element data

AAFCO Model Guidance Document: AAFCO Guidance for Contaminant Levels Permitted in Mineral Feed Ingredients.

NRC Mineral Tolerance of Animals: Arsenic and Lead chapters

Bates-Numbered Documents

WLPT00000024

WLPT00000027

WLPT00014986

WLPT00008059 - 00008097

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Other materials are referenced in my report.